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GEOLOGICAL SURVEY OF CANADA
ROBERT BELL, M.D., Sc.D., LL.D., F.R.S., ACTING DIRECTOR.

MESOZOIC FOSSILS

VOLUME I

PART V, (& last).—On some additional fossils from the Vancouver Cretaceous, with a revised list of the species therefrom.

—BY—

J. F. WHITEAVES, LL.D., F.G.S., F.R.S.C., ETC.

Palæontologist, Zoologist, and Assistant Director.

(WITH GENERAL TITLE PAGE, LETTER OF TRANSMITTAL, AND INDEX.)

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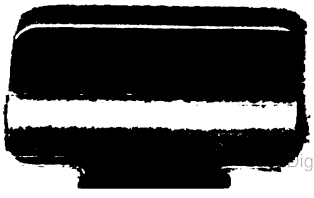
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To the binder.

Cancel the temporary title pages and letters of transmittal with Parts I, II, III and IV, and the temporary title page of Part V, and substitute the general title page and letter of transmittal herewith.

Bind all the letter press, pages 1–416, together first, and the plates, numbers 1–51, with their explanations, consecutively afterwards. Each plate to be on the right hand side, and its explanation to face it, on the left.

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ROBERT BELL, M.D., Sc.D., LL.D., F.R.S., ACTING DIRECTOR.

MESOZOIC FOSSILS

VOLUME I

— BY —

J. F. WHITEAVES, LL.D., F.G.S., F.R.S.C., ETC.

Palæontologist, Zoologist, and Assistant Director.

OTTAWA
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The present volume, as now completed, consists of five descriptive and illustrated Reports upon the fossils of the Cretaceous rocks of the Queen Charlotte and Vancouver islands.

Part I, consisting of pages 1 to 92 and plates 1 to 10 (in each case both inclusive) with map, was published in 1876; Part II, of pages 93–190 and plates 11–20, in 1879; Part III, of pages 191–262 and plates 21–32, in 1884; and Part IV, of pages 263–308 and plates 33–39, in 1900.

The part now submitted (Part V) which concludes the volume, and consists of pages 309–416 and plates 40–51, will bear date herewith.

ROBERT BELL.

GEOLOGICAL SURVEY DEPARTMENT,
OTTAWA, July, 1903.

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MESOZOIC FOSSILS.

BY J. F. WHITEAVES.

VOLUME I.

V.—On some additional fossils from the Vancouver Cretaceous, with a revised list of the species therefrom.

Prefatory Remarks.

The second part of this volume, which was published in 1879, consists of a descriptive and illustrated Report on the fossils of the Cretaceous rocks of Vancouver and the adjacent islands, collected by the late Mr. James Richardson, in the years 1871-1875, both included.

The present publication is a similar Report on the many collections of fossils from these rocks that have been received and studied since 1879, but more particularly during the last thirteen years. These collections may be briefly indicated as follows :—

Vancouver Island.—Fossils collected on the Puntledge River, near Comox, by the Rev. G. W. Taylor in 1889, by Mr. Walter Harvey in 1891 and 1892, by Dr. C. F. Newcombe in 1892, and by Mr. J. B. Bennett in 1895 and 1896 ; at North West Bay by Mr. Harvey in 1897 ; on the Nanaimo River, and at several localities near Nanaimo, by Mr. Harvey in 1901 ; and at Brennan Creek, near Wellington, by the Rev. G. W. Taylor in 1901. Brennan Creek, it may be mentioned, is two miles from Wellington. It runs, Mr. Taylor states, from the northern spur of Mount Benson, into Brennan Lake.

Denman Island.—Fossils collected by Mr. Harvey in 1892, 1893, 1895 and 1896.

Hornby Island.—Fossils collected by Mr. Harvey in 1892-95, by Dr. Newcombe in 1892, by Dr. Beadnell in 1895, by Mr. Robbins in 1893, 1895 and 1896, and by Mr. Bennett in 1896 and 1898.

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Texada Island.—One species of fossil brachiopoda and sixteen species of fossil mollusca from a small outlier of Cretaceous rocks discovered by Mr. Harvey in 1901, at the south-eastern end of the island, about half a mile from the beach, on the two south branches of a small creek emptying into Bull Passage, the channel between Texada and Lasqueti islands, opposite the most northerly point of the most northerly island forming the protection to Tucker Bay, on Lasqueti, and about five miles, or perhaps more, from the south end of Texada. The only Cretaceous fossils that had previously been obtained from this island are a few fossil plants from Gillies Bay, collected by Mr. Richardson in 1873.

Lasqueti Island.—Small collections of fossils made by Mr. Harvey in 1896 and 1901.

Sucia Islands.—Numerous fossils collected at these islands by Dr. Newcombe in 1894 and 1896.

For the opportunity of examining and studying these specimens, many of which have been presented to the Museum of the Survey, the writer is much obliged to the senders, especially to Mr. Harvey, to Dr. Newcombe, and the Rev. G. W. Taylor, for the many interesting fossils that they have so kindly forwarded.

Captain Palliser's Vancouver Island Fossils.—In 1896, the Geological Society of London, through its president, Dr. Henry Woodward, kindly lent to the writer all the Cretaceous fossils obtained at Vancouver Island in 1860 by Sir J. W. Hector, during Captain Palliser's explorations, that were then at Burlington House.

Fossils from the Provincial Museum at Victoria.—All the local Cretaceous fossils from this Museum, including many fine specimens collected at Hornby and Denman islands by Mr. Harvey in 1892, have also been kindly lent to the writer by its curator, Mr. John Fannin.

Since 1879, the following papers have been published on the Vancouver Cretaceous and its fossils.

1889.

Cretaceous Fossils from Vancouver Island Region.

By Dr. C. A. White.

Bulletin of the U. S. Geological Survey, No. 51, Part 3, pp. 33-48, pls. VI and VII.

This paper is based upon fossils from Sucia, Waldron and Sheep Jack* islands, received from Dr. Newberry, many of which are stated to have been collected by Mr. E. W. McClure. Three new species, viz., *Perna excavata*, *Vanikoropsis Suciensis*, and *Ammonites Maclurei*, are described and figured.

*Dr. Newcombe says that this last name should be written Skip Jack.

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1890

Notes on the Cretaceous of the British Columbia Region.

The Nanaimo Group.

By Dr. G. M. DAWSON.

American Journal of Science for March, 1900, Third Series, vol. XXXIX, pp. 180-183.

The "Nanaimo group" is here proposed as a "local name for the equivalent of the Chico group in the Vancouver Island region." It is defined as including the lower subdivisions A and B of Mr. Richardson's Nanaimo section, and A, B, C and D of his Comox section, as quoted on page 94 of the second part of this volume. The suggestion is also made that some at least of the higher subdivisions of these sections may represent the Tejon group of California, or the Puget group of the Puget Sound region.

1893.

Presidential Address: the Cretaceous System in Canada.

By J. F. WHITEAVES.

Transactions of the Royal Society of Canada for 1893, Series I, vol. XI, section IV, pp. 3-19. Separate copies distributed November, 1893.

Includes some general remarks and conclusions in regard to the Vancouver Cretaceous.

1895.

Notes on some fossils from the Cretaceous rocks of British Columbia, with descriptions of two species that appear to be new.

By J. F. WHITEAVES.

Canadian Record of Science for April, 1895, vol. VI, pp. 313-317, pl. II.

The supposed new species are *Heteroceras Hornbyense* and *H. perversum*.

1896.

Note on some of the Cretaceous fossils collected during Captain Palliser's explorations in British America in 1857-60.

By J. F. WHITEAVES.

Transactions of the Royal Society of Canada for 1895, Second Series, vol. I, section IV, pp. 101-117, pl. I.

1896.

On some Fossils from the Nanaimo group of the Vancouver Cretaceous.

By J. F. WHITEAVES.

Idem, pp. 119-136, pls. II and III.

1896.

On some Podophthalmatous Crustacea from the Cretaceous Formation of Vancouver and Queen Charlotte Islands.

By HENRY WOODWARD, LL.D., F.R.S., F.G.S.

Quarterly Journal of the Geological Society of London for May, 1896, vol. LIII, pp. 221-228, with six woodcuts in the text.

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1900.

Further notes on Podophthalmatous Crustaceans from the Upper Cretaceous Formation of British Columbia, etc.

By HENRY WOODWARD, LL.D., F.R.S., F.G.S.

Two papers, published in the Geological Magazine for September and October, 1900, Decade IV, vol. VII, pp. 392-401, and 433-435, pls. XV, XVI and XVII.

1901.

Description of a new species of *Unio* from the Cretaceous Rocks of the Nanaimo Coal-Field, V.I.

By J. F. WHITEAVES.

Ottawa Naturalist, January, 1901, vol. XIV, No. 10, pp. 177-179, figs. 1 and 1*a*.

The *Unio* is *U. Nanaimoensis*.

It was in 1869, in the second volume of the Palæontology of California, that Professor J. D. Whitney and Mr. W. Gabb first correlated the coal-bearing formation of Vancouver, which Dr. Dawson has called the Nanaimo group, with the Chico group of California. All the fossils enumerated or described in Part II., and in the present part of this volume, are from the Nanaimo group, which, as now understood, would appear to be not only the equivalent of the Chico group, but also of the Pierre-Fox Hills or Montana formation of Manitoba, the North-west Territories and the Upper Missouri County; also, in a general way, of the Upper Chalk of England and the Senonian of France. Dr. Kossmat correlates it with the Upper Senonian.

The fossil fauna of of the Nanaimo group, also, is strikingly similar to that of the higher beds of the Upper Cretaceous in the Island of Saghalien (Sachalin) in the Sea of Okhotsk, of Japan and Southern India. As a whole, its fauna is quite different to that of the somewhat older Cretaceous rocks of the Queen Charlotte Islands, though a few species appear to be common to both. These latter are,—an Ammonite that can scarcely be distinguished from *Tetragonites Timotheanus*; *Vanikoro pulchella*; *Nucula* (*Acila*) *truncata*; and perhaps *Trigonia Tryoniana*. *Phylloceras ramosum* and *Cucullæa truncata* of the Nanaimo group, also, are very nearly allied to *P. Knoxvillense* and *C. ponderosa* of the Queen Charlotte Island Cretaceous.

Some thin shaly beds of the Vancouver Cretaceous contain the remains of land plants, which have been described elsewhere by the late Sir J. W. Dawson and others, but the fauna of the Nanaimo group would seem to be almost exclusively marine. The only indications of land or fresh-water shells in these rocks that the writer has seen, are the type of *Unio Nanaimoensis*, from the Wellington mine, near Nanaimo, and six very imperfect specimens of a gasteropod, that is possibly not marine, from the roof of the coal at the Nanaimo mines. The following are some of

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the most striking features of this fauna, as indicated by the collections received since 1879 :—

1. *Fishes.* Indications of a true teleost, and of at least one species of Selachii.

2. *Crustacea.* The comparatively large number of species of Decapoda, nine of which have recently been described by Dr. Henry Woodward.

3. *Ammonitidæ.* An unusually large development of the genus *Pachydiscus*, both in specimens and in species. Not less than eight species of this genus are either enumerated or described in these pages. Curiously enough, no species of *Pachydiscus* has yet been discovered in the Cretaceous rocks of the Queen Charlotte Islands, though it is difficult to see what generic distinction there is between the *Pachydiscus Newberryanus* of the Vancouver, and the *Desmoceras p'anulatum* of the Queen Charlotte Island Cretaceous. Specimens of a species of *Baculites* are common in the Nanaimo group, but no Baculites have as yet been found in the Qneen Charlotte Island Cretaceous.

4. *Gasteropoda.* The occurrence of a small smooth species of *Cypræa*; of three large species that are probably referable to Deshayes' genus *Mesostoma*; of a *Solariella* that is scarcely distinct from the *S. radiatula* (Forbes) of the Cretaceous rocks of Saghalien and Southern India; and of a large limpet-like shell that is probably only a variety of the *Helcion giganteus* of the Saghalien Cretaceous.

5. *Pelecypoda.* The discovery of a *Unio* that is apparently distinct from the *U. Hubbardi*, Gabb, of the Queen Charlotte Island Cretaceous, and a considerable reduction in the number of species of *Inoceramus*, both the supposed *I. undulatoplicatus* of Rœmer and *I. mytilopsis* of Conrad being now regarded as forms of *I. digitatus* (Sowerby) Schmidt, from the Cretaceous of Texas, Saghalien and Nebraska.

In 1896, ten specimens and six photographs of various species of Ammonites, mostly critical species of *Pachydiscus*, from the Nanaimo group, were sent to Dr. Franz Kossmat, of Vienna, for direct comparison with certain species from Southern India, and Europe. Some interesting notes upon each of these specimens have been kindly communicated by Dr. Kossmat, and, with his permission, most of these notes are here quoted in full, in their proper place in these pages.

The writer, also, is greatly indebted to Dr. T. W. Stanton, of the U.S. Geological Survey, for comparing several critical fossils from the Nanaimo group, with Californian specimens in the U. S. National Museum; and to Mr. F. M. Anderson, for comparing fossils from the Vancouver Cretaceous, with some of Mr. Gabb's types and other specimens in the Geological Museum of the University of California at Berkeley.

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Determinations and Descriptions of Species.

FISHES.

Teleostei.

Very few remains of fishes appear to have been collected from the Vancouver Cretaceous. The only indications of teleosts in these rocks that the writer has seen, are portions of some small, deeply biconcave vertebræ, with long transverse processes, in two fragments of a concretionary nodule from Hornby Island, collected by Mr. Harvey in 1894. Dr. A. Smith Woodward, who has kindly examined these specimens, writes as follows in regard to them, in a letter dated April 28, 1896 :— "The group of small vertebræ, with very large transverse processes, and completely pierced by the notochord, probably belongs to a member of the Hoplopleuridæ (Dercetidæ). I do not know of any other Cretaceous vertebræ of the same kind."

Selachii (Elasmobranchii).

Asterospondylic Vertebra.

(Genus and species unknown).

Plate 44, fig. 1.

A small concretionary nodule from the Puntledge or Comox River, V. I., collected by Mr. Harvey in 1892, proves to be formed around the calcified centrum of one of the vertebræ of a Selachian. This centrum, which is shallowly biconcave, is a little over an inch in diameter, and marked by numerous close-set, annular striæ. It had such a distinctly X-shaped cleavage, that, when the nodule containing it was broken, the centrum separated into four flattened four-sided pyramids, which fit closely together, with their apices inward. Natural casts of either of the concave surfaces of this centrum are singularly like the upper valve of a *Discina*, and prove to be precisely the same as the fossil from Ganges Harbour, on Salt Spring or Admiralty Island, to which the name *Discina Vancouverensis* was given in the second part of this volume. This name, therefore, will have to be abandoned. In regard to the Comox River specimen, Dr. Woodward writes as follows : "The larger vertebra seems to belong to one of the Carchariidæ. We have some, generically undetermined, exhibiting the same kind of fracture."

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Lamna appendiculata, Agassiz.

Otodus appendiculatus, L. Agassiz. 1843. Poiss. Foss., vol. III, p. 270, pl. xxxii, figs. 1—25.

Lamna appendiculata, A. S. Woodward. 1889. Cat. Foss. Fishes Brit. Mus., Part I, p. 393; which see for a full list of synonyms and references for this species.

A rather small, well preserved and practically perfect shark's tooth, from Brennan Creek, near Wellington, V. I., collected by the Rev. G. W. Taylor in 1901, and presented by him to the Museum of the Survey, appears to be referable to this species.

The tooth is strongly compressed, rather thin and a little broader than high. Its maximum height is 12.2 mm., and its greatest breadth 13.5. The crown is obliquely pointed and prominent, with a small denticle on each side. Its cutting edge is extremely thin and sharp, and its base very shallowly but angularly emarginate. At its mid-breadth and just above the base there is a faint shallow depression, partially filled by a very obscure and short longitudinal plication, with a still more obscure and shorter one on one side. The whole surface of the crown is smooth and polished. The root of the tooth consists of a flat strip of tissue without enamel, from 3.5 to 4 mm. high, running practically parallel to the root of the crown.

An imperfect but otherwise very similar tooth was collected by Mr. J. B. Tyrrell in 1885, from the Cretaceous rocks on the Battle River, Saskatchewan.

Although Agassiz once thought that this species is peculiar to the Chalk, Dr. Woodward now says that it ranges in time from the Gault to the Upper Chalk, and, in its geographical distribution, from the south of England and Northern Europe to New Jersey and North Queensland.

CRUSTACEA.

Decapoda.

Brachyura.

Plagiolophus Vancouverensis, Woodward.

Plagiolophus vancouverensis, H. Woodward. 1896. Quart. Journ. Geol. Soc. Lond., vol. LII, pp. 226–228.

The original description of this species is as follows, but the number prefixed to the name is omitted, and the numbers of the two figures are altered to suit this volume.

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"Genus PLAGIOLOPHUS, Bell.

In this genus the carapace is transversely ovate, the regions of the cephalothorax are distinctly marked, front somewhat prominent, the eyes subdistant, superior border of the orbits with two fissures, etc."

Plagiolophus vancouverensis, sp. nov. (Figs 15 and 16 on this page; figs. 5 and 6 of the original description.)

"This crab is represented by four specimens, three of which I received from Mr. Whiteaves, and the remaining one is preserved in the Museum of the Geological Society.

"The carapaces vary in size from :—

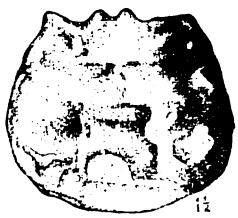
		Millimetres.	
		long	broad
1.	Geological Society's specimen	22	23
2.	From Comox River, Vancouver Island (fig. 15). .	20	25
3.	N. W. side, Hornby Island.....	16	20
4.	N. W. side, Hornby Island, (fig. 16).	10	13

"No. 1 and No. 2 are $\frac{1}{4}$ broader than long, No. 3 is $\frac{1}{5}$, and No. 4 is $\frac{1}{4}$ broader than long,

"The frontal border is straight; the rostrum is bifid, with two small rounded elevations divided by a groove; the orbital region is smooth and but little indented; the lateral borders are very gently rounded, the posterior border is nearly straight. The cardiac and metabranchial lobes, the metagastric and epibranchial lobes, and the two mesogastric lobes form three almost parallel lines across the carapace, giving it a very unique linear arrangement; there are also two much smaller lobes, one behind each of the orbits, flanked laterally by a small tubercle on each epibranchial lobe; the lateral border was bluntly dentated.

FIG. 15.

FIG. 16.



"When not waterworn (as in specimen No. 4), the surface of the carapace is in parts very finely granulated.

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"These specimens are very distinct, but without more materials I should not feel justified in separating them generically. I prefer rather to place them in Bell's genus *Plagiolophus*, which was proposed to receive *P. Wetherelli*, from the London Clay of Sheppey.

"The same species—described under the name of *Glyphithyreus affinis* (Reuss)—was figured and described by Reuss nearly at the same date. Reuss also adds another species, *Glyphithyreus formosus*, Reuss, from the Upper Cretaceous of Mecklenburg.

"I feel satisfied to leave these Vancouver Island crabs in this genus, and to designate them by the trivial name of *vancouverensis*.

"Two specimens were collected on the north-western side of Hornby Island, and one on Comox River, Vancouver Island, British Columbia. The locality of the Geological Society's specimen is not marked, but it is from Vancouver Island.

"Nos. 3 and 4, from Hornby Island, belong to the Provincial Museum of Victoria, Vancouver Island.

"No. 2 specimen shows traces of limbs, and the flattened propodos of a chelate fore-arm 13 millim. long × 8 millim. broad."

The three specimens forwarded by the writer were collected by Mr. Walter Harvey, who says that he got one specimen of this species on the Puntledge or Comox River, at Comox, V.I., in 1891, several at Hornby Island in 1892, 1893 and 1896, and a few at Denman Island in 1892 and 1893. One of the specimens collected by Mr. Harvey at Hornby Island in 1896, and now in the Museum of the Survey, has almost the whole of the ten walking legs preserved.

Palæocorystes Harveyi, Woodward.

Palæocorystes Harveyi, H. Woodward. 1896. Quart. Journ. Geol. Soc. Lond., vol. LII, pp. 225 and 226.

The following is the original description of this species, but the number of the figure is altered to suit this publication.

"Genus Palæocorystes, Bell.

"In this genus the carapace is longer than broad, flattish, becoming narrower gradually towards the posterior border, rostrum short, latero-anterior border dentated. Orbits moderately broad, with two fissures.

"The carapace in all the species of this genus at present known is similar to that of the masked crab, *Corystes*, now living on our English coasts.

"*Palæocorystes Harveyi*, sp. nov. (Fig. 17.)

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"The genus *Palæocorystes*, to which I have referred two of the specimens sent to me by Mr. Whiteaves, is well represented in the Gault Greensand, Chalk and Eocene.

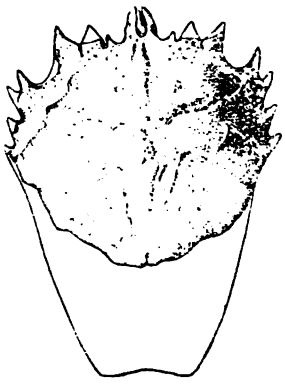
"Thus we have:—

Palæocorystes Broderipii, Mantell, sp.; Gault, Folkestone.
—— *Stokesii*, Mantell, sp.; Gault and Greensand, Cambridge and Folkestone.
—— *Normanni*, Bell; Chalk Marl, Isle of Wight.
—— *Mulleri*, Bink; Upper Chalk, Maestricht.
—— *Callianassarum*, Fritsch; Chalk, Bohemia.
—— *isericus*, Fritsch; Chalk, Bohemia.
—— *glabra*, H. W.; Lower Eocene, Portsmouth.
Eucorystes Carteri, M'Coy; Greensand, Cambridge.

"Both the specimens from Canada are imperfect. One of them (No. 2, fig. 17) shows the anterior upper surface of the carapace, the other (No. 3) the posterior upper surface. From these we are able to make the following diagnosis:—

"*Specific characters.* Length of carapace 35 millim., from the rostrum to the broken posterior border (to this we must probably add 15 millim. more, making the total length from the rostrum to the posterior border of the carapace 50 millim.); greatest breadth across the hepatic region 37 millim.

FIG. 17.



"(No. 2 was collected by Mr. W. Harvey, Comox River, Vancouver Island, 1892; No. 3 by Dr. C. F. Newcombe.)

"Carapace smooth and gently convex in front, and very finely and minutely granulated. Latero-anterior border armed with four serrations on each side, frontal border marked by one prominent and one smaller tooth on either side of the small bifid rostrum, while two fissures mark the margin of each orbit. Under surface of carapace not exposed.

"The regions of the carapace are very indistinct; two slightly divergent raised lines about 5 millim. in length mark the frontal region just behind the rostrum, and there is a faint ridge down the centre of the carapace. A small tubercle on either side, behind the frontal region, marks the epigastric lobe. A faint curved and bifurcating line separates the gastric from the cardiac regions, while two slightly rugose and incised lines curve outward and forward from the central cardiac region, marking the limits of the branchial region on either side.

"Of the several species of *Palæocorystes* known, the present form, which I have ventured to call *P. Harveyi* after its discoverer, approaches most nearly to *P. Broderipii* from the Gault of Folkestone, but is probably

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one-third larger. The latero-anterior border of the former (*P. Harveyi*) has four spines on each side, whilst *P. Broderipii* has only two. The orbital regions differ in form, as well as the markings on the regions of the carapace.

"We must await more complete materials before attempting a fuller and more careful description; meantime it is interesting to meet with a species from so distant a locality which approaches so nearly to our own Gault species *P. Broderipii*.

"*Formation.*—Cretaceous. *Localities.*—Hornby Island (No. 2); and Comox River, Vancouver Island (No. 3)."

No. 2 is labelled "N. W. side of Hornby Island, W. Harvey, 1892"; and No. 3, "Comox River, at Comox, V. I., C.F. Newcombe, 1892"; but Mr. Harvey says that both were collected on the Puntledge or Comox River, and that the species has not yet been found at Hornby Island.

A third specimen of the carapace of *P. Harveyi*, collected on the Comox River by Mr. J. M. Bennett, in 1896, has been presented by him to the Museum of the Survey. It is very similar to the original of figure 17, but has more of the test preserved.

Macrura.

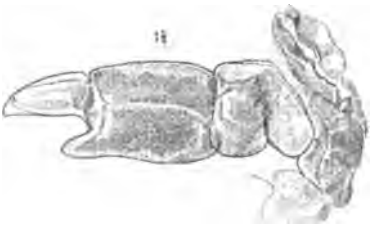
Callianassa Whiteavesii, Woodward.

Callianassa Whiteavesii, H. Woodward. 1896. Quart. Journ. Geol. Soc. Lond., vol. LII, p. 223, figs. 1 and 2; and (1900) Geol. Mag., Dec. IV, vol. VII, p. 435, pl. 17, figs. 2, *a b*.

Original description.—"General integument of body extremely thin, or semimembranous, except the first pair of feet, which are protected by a hard covering. Anterior feet (chelipeds) very unequal; length of larger limb 39 millim.; breadth 9 millim.; the dactylus is straight, and is 9 millim. long, but the fixed thumb of the propodos is rudimentary and stout, being only half as long as the movable finger. Length of smaller hand about 20 millim. Surface of hands faintly wrinkled.

"There are indications of the segments of the abdomen and of the thin integument with which they were covered, also of the small thoracic legs, but they are too much broken up for detailed description.

Fig. 18.



"In this species from Vancouver Island the fixed thumb of the propodos is shorter than in any of the

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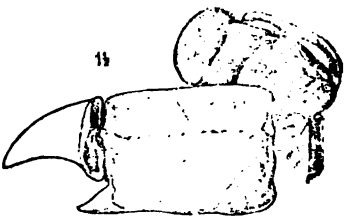
species hitherto recorded, and the movable finger (dactylus) is straighter.

Fig. 19.



"The species is smaller than that from the Chalk of Dulmen, Westphalia, or from Maestricht, or Belfast. I have designated it *Callianassa Whiteavesii*, in honour of my friend Mr. J. F. Whiteaves, who has done so much for the elucidation of the Cretaceous formation in Canada.

"Original specimens" (figs. 18 and 19) "preserved in concretionary nodules of Cretaceous age from Comox River, Vancouver Island. Collected by Dr. C. F. Newcombe (1892). Museum of the Geological Survey of Canada, Ottawa.

"A nodule from Vancouver Island, in the Geological Society's Museum, contains the remains of the large hands of *Callianassa Whiteavesii*. A second nodule from the same collection contains the carapace of *Plagiolophus vancouverensis*" (Woodward).

Remains of one or possibly two individuals, that Dr. Woodward has since identified with this species, had previously been collected on the Puntledge or Comox River, near Comox, by the Rev. G. W. Taylor in 1889, and are now in the Museum of the Survey. Specimens collected at Hornby and Denman islands by Mr. Harvey in 1892 or 1893, that are probably referable to this species, have been loaned to the writer by the authorities of the Provincial Museum at Victoria, B.C. Dr. Woodward also identifies with *C. Whiteavesii*, several "well-preserved, flattened chelate hands" collected at Sounding Creek (in the north-west corner of the District of Assiniboia), by Mr. J. B. Tyrrell, in 1886, but these are from the Pierre-Fox Hills or Montana formation, of the country east of the mountains.

Hoploparia Bennettii, Woodward.

Hoploparia Bennettii, H. Woodward. 1900. Geol. Mag., Dec. IV, vol. VII, p. 433.

Original description.—"This species is based on a very imperfectly preserved specimen, No. 5 in list, contained in a dark nodule (measuring 5″ × 2″) split in halves very irregularly, and exposing the dorsal aspect of five posterior abdominal somites and the telson with two swimmerets on the left side still attached. The abdominal segments are smooth, and the epimera broadly falcate and pointed as in *Homarus*. Length of five abdominal segments, 40 mm.; length of telson, 13 mm.; breadth of abdomen 25 mm.

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"The sternites are still attached to the abdomen, but the carapace has been removed, exposing the inner and upper surface of the cephalothorax, with the bases of five pairs of ambulatory appendages still attached. Length of cephalothoracic portion, 30 mm. Some of the small ambulatory legs on the left side are preserved nearly to their extremities, and the bases of the large (chelate) fore-legs can also be seen, one joint of which shows a tuberculated surface. Length of base of area of sternites, 25 mm.; greatest breadth, 15 mm. There is no trace whatever of the presence of large palinurid antennæ. This and the general character of the thoracic appendages and the form of the abdomen, resembling the modern *Homarus* rather than *Palinurus*, lead me to refer this fossil to the genus *Hoploparia*. I have added the specific name of *Bennettii* after its discoverer.

"Formation: Upper Cretaceous.

"Locality: Comox River; collected by Mr. J. Bennett in 1895."—(Woodward).

No other specimen is known to the writer.

Enoploclytia minor, Woodward.

Enoploclytia minor, H. Woodward. 1900. Geol. Mag., Dec. IV, vol. VII, p. 434.

"The evidence for this species consists of a nodule (4″ × 3″, No. 9 in Dr. Whiteaves' list, marked also 59 in white paint) split into two parts, but affording little comfort to the investigator. One can make out an imperfectly preserved carapace (cephalothorax), with a tuberculated surface from which two pairs of imperfectly preserved antennæ take their origin and the flagella of which can be indistinctly traced. These are followed by a pair of long and slender chelate appendages, with finely tuberculated surfaces, the fingers of the forceps being long and slender as in *Enoploclytia Leachii*. Two pairs of slender ambulatory legs follow; these also have forcipated or chelate extremities. The abdominal segments are slender and only imperfectly preserved.

"The specimen is from the Upper Cretaceous of Hornby Island, and was obtained by Mr. W. Harvey in 1893." (Woodward.)

Eryma Dawsoni, Woodward.

Plate 41, fig. 2*.

Eryma Dawsoni, H. Woodward. 1900. Geol. Mag., Dec. IV, vol. VII, p. 400, pl. XVI, fig. 2.

"Among the specimens which form a second collection sent by Dr. J. F. Whiteaves (24th September, 1898) from the Geological Survey of

*Plates 40 and 41 of this volume are printed from the same stone as Plates XV and XVI of the Geological Magazine for September and October, 1900, but the lettering of the upper part of each of the former has been altered to suit this publication.

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Canada, is the half of a nodule containing an Astacidean from the Upper Cretaceous of the north-east side of Hornby Island, British Columbia, collected by J. B. Bennett in 1898 (No. 55D).

"The Crustacean is seen in profile on the split surface of a nodule, and exhibits the cephalothorax, with its stout pair of chelate limbs (or forceps) attached, and the remains of the four pairs of succeeding ambulatory legs, the six abdominal somites, and the telson, but the lateral lobe of the tail-fin was probably preserved in the other half of the nodule not sent. The branchiostegite (covering the branchiæ) is broad and tumid, and the branchiocardiac groove is strongly marked. Starting from the median dorsal line as a V-shaped furrow, about 12 millimetres from the posterior border, it bends rapidly forward, becoming deeper on each side, and reaches the lateral border 24 mm. in advance; here it unites, close to the hepatic lobe, with the equally deep but more transverse cervical furrow, which crosses the carapace 10 mm. nearer to the front. In advance of the cervical groove the postorbital ridge and spine can be seen, also the base of one of the antennules, with part of one of its flagella, beneath the somewhat short rostrum, and lower down the base of one of the outer and larger antennæ. The surface of the branchiostegite is marked by numerous small tubercles scattered irregularly over the surface. The branchial, cardiac, and hepatic regions are also similarly tuberculated, and very tumid. Length of carapace 48 mm., depth of side 25 mm. The ambulatory limbs are fairly long and slender; the chelate limbs measure about 60 mm. in length; length of penultimate joint 35 mm., breadth 15 mm., length of ultimate joint 20 mm. The fingers are long and slender, the inner edge of the forceps being denticulated; wrist 6 mm. long by 10 mm. broad. The epimeral border of each abdominal segment is falcate in contour.

"The general form and details of this Crustacean, so far as preserved, clearly mark its place among the Astacidea, or under the Astacomorpha (as defined by Huxley, 1881), and I would suggest that Oppel's name of *Eryma* is appropriate for it, seeing that it agrees very closely in the divisions of its carapace and its tuberculated surface, in the antennæ, the form of the first pair of forcipated chelæ, and the proportion of its abdomen, with *E. Perroni* and other Jurassic species.

"Oppel observes that no examples of the genus *Eryma* have been found in rocks younger than the Jurassic, and that the Astacidæ of the Chalk are placed in McCoy's genera *Hoploparia* and *Enoploclytia*, but in this instance the form in question agrees much more closely with Oppel's genus *Eryma* than with other forms. I therefore propose to relegate it to that genus, and to designate it by the specific name of *Dawsoni*, in honour of Dr. G. M. Dawson, C.M.G., F.R.S., the eminent Director of the Geological

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Survey of Canada, who has done such splendid work in the field in mapping the geology of British Columbia."—(Woodward).

Meyeria ? Harveyi, Woodward.

Meyeria? Harveyi, H. Woodward. 1900. Geol. Mag., Dec. IV, vol. VII, p. 434.

"The evidence of this species rests on a single specimen exposed on the half of a fractured nodule ($3\frac{1}{2}$ inches × $2\frac{1}{2}$ inches), marked No. 8 in list. It is also marked 3 in ink. It was obtained by Mr. W. Harvey, in 1895, at Hornby Island, and shows the remains of the abdominal somites and the long slender rugose fore-limbs of the cephalothorax ($2\frac{1}{4}$ inches in length by $\frac{1}{8}$ inch in thickness). They do not appear to have possessed forceps at their extremities, but were monodactylous. The form of the epimera of the abdomen agrees with *Meyeria vectensis* in shape.

"From the Upper Cretaceous. Named after its discoverer, Mr. W. Harvey" (Woodward).

Glyphæa. Sp. nov.

Several specimens of a small and apparently undescribed species of *Glyphæa* were collected by Mr. Harvey in September, 1901, from shale forming the roof of the coal at No. 1 shaft, Nanaimo, V.I. Most of these specimens, however, are crushed, distorted or badly preserved, and none of them are sufficiently perfect to furnish the material for a detailed or sufficiently accurate description of the species. About all that can be said of its characters is that the rostrum is apparently short and pointed, and that the carapace, in front of the nuchal furrow, and the large pinching claws, are marked with narrow longitudinal ridges, and minute rounded tubercles that may be spine bases.

Linuparus Vancouverensis, Whiteaves.

Plate 40, figs. 1, 2 and 3.

Podocrates Vancouverensis, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. 1, p. 132.

Linuparus Vancouverensis, H. Woodward. 1900. Geol. Mag., Dec. IV, vol. VII, p. 394, plate XV, figs. 1, 2 and 3.

Original description.—"Carapace flattened, rectangular, longer than broad, marked by three low angular tuberculous or spinose longitudinal ridges, one in the median line and one near each of the lateral margins, and divided at about one-third of the distance from the front by an obtusely subangular cervical groove, which is rather broad but not very deep. On the anterior portion or cephalic arch the lateral longitudinal ridges are well

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developed, and armed with larger and more spinose tubercles than those on the corresponding ridges of the posterior portion, one a little behind the mid-length on each ridge being larger than any of the others, but the central ridge is obsolete. In its place, just in advance of the cervical groove, there is an ovate lanceolate or narrowly spear-shaped area, which is elevated at the pointed end anteriorly, shallowly depressed posteriorly, and margined with a single row of small tubercles. Immediately in front of this area is a pointed or spinose tubercle, almost in a line with the largest tubercle on each of the lateral ridges, and still farther forward there are two similar tubercles at a short distance from the anterior margin and about seven millimetres apart. On the posterior portion or scapular arch, the three longitudinal ridges are minutely tuberculated, and extend from the posterior margin to the cervical groove, where they each terminate in a pointed tubercle larger than any of the rest, but the central ridge is shorter than either of the two lateral ridges. Anterolateral angles of the carapace, each armed with a nearly straight but slightly divergent spine. Rostrum, central portion of the anterior margin, and position of the eyes unknown. External antennæ broad and flattened at their bases, inner antennæ cylindrical at theirs. Walking feet slender, as is usual in the genus. In addition to the spines and tubercles on the lateral ridges and elsewhere, as already described, the whole of the upper surface of the carapace is minutely granulose and apparently setose, numbers of minute objects which seem to be detached setæ, being plainly visible under an ordinary lens.

"Two miles up the Puntledge River, Vancouver Island, Rev. G. W. Taylor, 1889: a good specimen of the carapace, with the rostrum and a small piece of the anterior extremity broken off, but with considerable portions of the ambulatory feet and the bases of the inner and outer antennæ preserved. This interesting fossil is now in the Museum of the Geological Survey of Canada. [See Pl. 40, Fig. 1.]

"Hornby Island, W. Harvey, 1893: a less perfectly preserved specimen, showing most of the carapace (but not the rostrum), portions of the ambulatory feet, and the dorsal aspect of four segments of the abdomen, though it is uncertain whether their margins were denticulated or not."

In regard to this Hornby Island specimen, Dr. Woodward says that it "shows the cephalothorax and a portion of the base of the left antenna. The three characteristic longitudinal ridges, the small central pear-shaped area in front of the neck-furrow on the carapace, and five of the abdominal segments can also be seen. Their margins are denticulated." (Geol. Mag., Sept., 1900, pp. 393 and 396.)

Three other specimens of this species have since been obtained, which are thus described by Dr. Woodward (op. cit., p. 393.)

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"No. 4. A long, dark, and rather cylindrical nodule ($6\frac{1}{2}'' \times 2\frac{1}{2}''$), split in halves and also broken across transversely, exposing the interior of the cephalothorax and five segments of the abdomen of *Linuparus (P.) Vancouverensis*, W." (Pl. 40, Fig. 2). "The upper surface of the carapace is not preserved, but the bases of the mandibles (*m.*) are exposed, the monodactylous walking legs, and the bases of the antennules. The epimeral portions of the abdominal segments are serrated behind, and bear small tubercles on the surface. Formation: Upper Cretaceous. Locality: Comox River, Vancouver Island; coll. by J. B. Bennett, 1895.

"No. 6. Half of a nodule only ($7'' \times 4\frac{3}{4}''$), containing an obscurely preserved Crustacean, *Linuparus (P.) Vancouverensis*, showing characteristic traces of the carapace and limbs and the nearly entire abdomen, including remains of the caudal appendages. The posterior borders of the epimera are spinous. The right antenna is preserved for a length of $2\frac{1}{2}$ inches. Formation: Upper Cretaceous. Locality: Hornby Island; coll. by W. Harvey, 1895. (Specimen also marked No. 1 in ink.)

"No. 55 *a* and *b*. Two sides of a dark egg-shaped nodule split open ($4\frac{1}{2}'' \times 3\frac{3}{8}''$), exposing the dorsal aspect of a specimen of *Linuparus (P.) Vancouverensis*. W." (Pl. 40, Fig. 3), "showing the carapace and the five abdominal segments, also the remains of the caudal appendages and the thoracic limbs. The three characteristic ridges are well seen, also the cervical furrow, with its pear-shaped tuberculated area just in front. Formation: Upper Cretaceous. Locality: Hornby Island; coll. by Mr. Robbins in 1896, Provincial Museum, Victoria, British Columbia."

Linuparus Canadensis, Whiteaves.

Plate 41, fig. 1.

Hoploparia (?) Canadensis, Whiteaves. 1884. Trans. Royal Soc. Canada for 1884, vol. II, sect. IV, p. 237; and (1885) Contr. to Canad. Palæont., vol. I, p. 87, pl. XI.

Podocrates Canadensis, Whiteaves. 1896. Trans. Royal Soc. Canada, Second Series, vol. I, sect. IV, p. 133.

Linuparus atavus, Ortmann. 1897. Amer. Jour. Sc., Fourth Series, vol. IV, p. 290, and figs. 1, 2 and 3, facing page 296.

Linuparus Canadensis, Whiteaves. 1898. Contr. to Canad. Palæont., vol. I, p. 419; and H. Woodward (1900) Geol. Mag., Dec. IV, vol. VII, pp. 396-399, pl. XVI, fig. 1.

The type of this species is a single specimen from the Cretaceous shales of the Highwood River, Alberta, collected by Mr. R. G. McConnell in 1882. The Highwood is a tributary of the Bow River, and the shales at that locality are supposed to be the Canadian equivalents of the Fort Benton group of the Upper Missouri section.

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Dr. Woodward (op. cit., pp. 398 & 399) identifies two specimens from Hornby Island with *L. Canadensis*, although no other species that the writer is aware of, is yet known to be common to the Nanaimo group of the Vancouver Cretaceous and the Fort Benton formation of the country to the east of the mountains. Dr. Woodward's notes on these Hornby Island specimens as are follows:

No. 55 *c*. One half of a dark nodule (6¼″ × 4″), exposing the under side of a large Crustacean, showing the five sternites and the bases of the thoracic limbs." (Pl. 41, fig. 1.) "I have referred this specimen to Dr. Whiteaves' species *L. Canadensis*, with which it agrees in size, being one of the largest specimens of the fossil Palinurids from this locality.

"It exhibits the under surface of the cephalothorax, with the sterna and the basal joints and portions of the five pairs of ambulatory appendages, one or more being nearly complete. The sternum forms a rather broad and somewhat triangular area, in front of which the mandibles and the labrum are seen, with the spinous stout basal joints of the long stiff antennæ. There are also traces of the antennules visible.

"Each sternite, carrying the thoracic limbs, is ornamented with a pair of rounded, sub-central tubercles, except the first, which has only a single central one.

"Upper Cretaceous: Hornby Island; collected by Mr. Robbins, preserved in the Provincial Museum at Victoria, B.C.

"Here I would also place a second specimen, preserved in a half nodule No. 7 (marked 2 in ink), which I refer to *L. Canadensis*. The half nodule measures 6″ × 4″, and displays one of the large antennæ and five of the walking legs very well preserved. The surface of the appendages is rugose. Three of the body-segments can be seen. Locality: Hornby Island; W. Harvey, 1895."

MOLLUSCA.

Cephalopoda.

(Dibranchiata.)

Belemnites. (Species indeterminable.)

Beach at Hornby Island, W. Harvey, 1892: a slender phragmocone, forty millimetres long and seven broad at the larger end. The chambers, as seen when part of the surface is rubbed down, are very numerous, and the siphuncle is marginal.

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(TETRABRANCHIATA.)

NAUTILOIDEA.

NAUTILUS CAMPBELLI, Meek.

Nautilus Campbelli, Meek. 1861. Proc. Acad. Nat. Sc. Philad., vol. XIII, p. 318.
" " " 1876. Bull. Geol. and Geogr. Surv. Terr., vol. II, no. 4, p. 373, pl. 6, figs. 2 & 2 *a*.
" " " Whiteaves. 1879. This volume, pt. 2, p. 99, pl. 11, figs. 2, 2 *a-b*.

North-west side of Hornby Island, W. Harvey, 1895: one specimen. The type of *N. Campbelli* was collected at Comox, V.I., apparently by Mr. George Gibbs in 1858. Mr. Richardson obtained one specimen of this species at Hornby Island in 1872, and another at the Sucia Islands in 1875. It is most likely also that the specimen from the Nanaimo River referred to on page 100 of this volume, which, according to Dr. Shumard, "appears to be identical with *Nautilus DeKayi*, Morton," is referable to *N. Campbelli*.

NAUTILUS SUCIENSIS, Whiteaves.

Nautilus Suciensis, Whiteaves. 1879. This volume, p. 97, pl. 11, figs. 1 & 1 *a*; but not the specimens from the Queen Charlotte Islands described on pp. 197 and 198, one of which is figured on pl. 21.

Sucia Islands, Dr. C. F. Newcombe, 1894: one imperfect specimen. This is the only locality at which the species, as now restricted, has been collected.

AMMONOIDEA.

PHYLLOCERAS RAMOSUM, Meek.

Ammonites (Scaphites ?) ramosus, Meek. 1857. Trans. Albany Inst., vol. IV, p. 45.
Phylloceras ramosus, Meek. 1876. Bull. Geol. and Geogr. Surv. Terr., vol. II, No. 4, p. 371, pl. 5, figs. 1, 1 *a* and 1 *b*.
Ammonites Velledæ, Whiteaves. 1879. This volume, pt. 2, p. 103; but apparently not of European authors, as now understood.

North-west side of Hornby Island: W. Harvey, 1892, two fine specimens; F. W. Robbins, 1893, two specimens; and W. Harvey, 1895, one specimen. East side of Denman Island, W. Harvey, 1895: a crushed and imperfect but large specimen about four inches and a half in its maximum diameter. Brennan Creek, near Wellington, V. I., Rev. G. W. Taylor, 1901: a small but well preserved specimen. The species had previously been collected at Nanaimo, Comox, and the Sucia Islands

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Dr. C. F. Newcombe informs the writer that in the Provincial Museum at Victoria, V.I., there is a specimen collected at the north end of the western limb of the main Sucia Island by H. K. Kalloch in 1894, that is apparently referable to *P. ramosum*, and that is eighteen inches in its maximum diameter. Two excellent photographs of this specimen, kindly forwarded by Dr. Newcombe, certainly seem to corroborate the correctness of this identification. They give the impression of a shell with essentially the same surface markings and much the same general shape as the small specimen of *P. ramosum* figured by Meek (which is less than two inches in its maximum diameter), but with a proportionately rather wider umbilicus. In this large specimen the umbilicus seems to occupy nearly one-sixth of the entire diameter, and it clearly exposes a small portion of some of the inner volutions. The sutural lines are for the most part covered by the test, but in the few places where portions of them are exposed, they appear to be very like those of the typical *P. ramosum*.

One of the Ammonites sent to Dr. Kossmat in 1896, is the specimen of *P. ramosum* from Hornby Island collected by Mr. Harvey in 1895. Its test is well preserved and its maximum diameter is about two inches. Judging by this specimen, Dr. Kossmat thinks that both *P. ramosum* and *P. Nera* (the *Ammonites Nera* of Forbes) are distinct from the true *P. Velledæ* (the *Ammonites Velledæ* of European authors and of the Palæontologia Indica), but that *P. ramosum* is the same as *P. Nera*, and should therefore be called by the latter name. In the Hornby Island specimen of *P. ramosum*, Dr. Kossmat writes that he sees "short radiating impressions round the umbilicus," like those of *P. Nera*, but these appear to the writer to be merely very indistinct, shallow, distant, radiating depressions. It is quite possible that *P. ramosum* may be synonymous with *P. Nera*, but for the present the writer prefers to retain the former name for the specimens from the Vancouver Cretaceous.

Phylloceras Forbesianum, d'Orbigny. (Sp.)

Ammonites Rouyanus (d'Orbigny) Forbes. 1845. Trans. Geol. Soc. Lond., Ser. 2, vol. VII, pl. 8, fig. 6.

Ammonites Forbesianus, d'Orbigny. 1850. Prodr. de Paléont., vol. II, p. 213.

Ammonites Rouyanus, Stoliczka. 1865. Cret. Cephal. S. India, vol. I, p. 117, pl. 59, figs. 5—7.

Phylloceras Forbesianum, Kossmat. 1894. Beitr. zur. Palæont. Oesterreich-Ungarns, vol. IX, p. 109 (13); and pl. 15 (1), figs. 1, *a—d*.

A specimen from the north-west side of Hornby Island, collected by Mr. Harvey in 1895, and now in the Museum of the Survey, has been identified with this species by Dr. Kossmat. It is a cast of the interior

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of the shell, about two inches and three-quarters in its maximum diameter. A little of the shell is preserved on the cast, and the sutural line is excellently well shown.

Gaudryceras Denmanense, Whiteaves.

Ammonites Jukesii? Sharpe. Whiteaves. 1879. This volume, pt. I, p. 111, pl. 13, figs. 3, 3 *a*, *b*; but perhaps not the true *A. Jukesii*, Sharpe.

Lytoceras Jukesii, Whiteaves. 1896. Trans. Royal Soc. Canada, Second Series, vol. I, sect. IV, p. 129, pl. 2, figs. 1 and 2.

Lytoceras (Gaudryceras) Denmanense, Whiteaves. 1901. Ottawa Naturalist, vol. XV, p. 32.

Seven fine examples of this beautiful species, three of which are now in the Museum of the Survey, were collected at Denman Island, near Hornby Island, in the Strait of Georgia, by Mr. Harvey, four in 1892 and three in 1895. A characteristic fragment, also, of *G. Denmanense*, was collected at Hornby Island by Mr. Harvey in 1892. A small specimen, some forty-three millimetres in its greatest diameter, collected at Brennan Creek, V. I., by the Rev. G. W. Taylor in 1901, is probably referable to this species. The only other specimen of this shell that the writer has seen is the fragment from Norris Rock referred to, under the name *Ammonites Jukesii*, on page 112, and figured on Plate 13, of the second part of this volume.

Tetragonites Timotheanus? Mayor.

Cfr. *Ammonites Timotheanus* (Mayor) Pictet and Roux. 1847. Moll. des Grès Verts, &c., p. 39, pl. II, fig. 6, and pl. III, figs. 1 and 2.

" " " Stoliczka. 1865. Cret. Cephal. S. India, vol. I, p. 146, pl. 73, figs. 3, 4 and 6.

" " " Fr. Schmidt. 1873. Petrif. der Kreide von Sachalin, p. 14, pl. II, figs 7-11.

" " " Whiteaves. 1876. This volume, pt. I, p. 41, pl. 3, figs. 2 and 2 *a*.

Cfr. *Lytoceras Timotheanum*, Whiteaves. 1884. Idem, pt. 3, p. 203 (which see for some synonyms that it is not thought desirable to reprint here).

Cfr. *Lytoceras (Tetragonites) Timotheanum*. Kossmat. 1894. Beitr. zur Palæont. Oesterreich-Ungarns und des Orients, vol. IX, p. 133 (37), pl. XVII (III), figs. 11 and 13 *a*, *b*.

Four specimens, that agree very well with Stoliczka's description and figures of *Ammonites Timotheanus*, have recently been found in the Vancouver Cretaceous. The specimens, which are now in the Museum of the Survey, are, at any rate, essentially similar to those from the Queen Charlotte Island Cretaceous that are referred to *A. Timotheanus* in the

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first part of this volume, and to *Lytoceras Timotheanum* in the third and fourth. Figure 2 of Plate III of the first part of this volume, which was intended to represent a small specimen of *A. Timotheanus* from Skidegate Inlet, is however not very satisfactory, the periodic constrictions being much too flexuous in the lateral region. In fact, the only difference that the writer has been able to detect between the specimens from British Columbia and Stoliczka's figures of *A. Timotheanus* is that, in the former, these constrictions are nearly straight, as well as very oblique, on the sides; and in the latter they are slightly curved. And, it should also be borne in mind, that, according to Dr. Kossmat, the geological horizons of *Tetragonites Timotheanus* are the Upper Gault and Lower Cenomanian, so that everywhere else than in Vancouver Island, the species would appear to occur in deposits that are much older than the Nanaimo group or Senonian.

These four specimens from Vancouver Island may be briefly indicated as follows:

One is a cast of the interior of the shell, with a small portion of the test preserved, collected on the Puntledge or Comox River, near Comox, by Mr. Harvey in 1895. Its maximum diameter is fifty-eight millimetres, it shows two oblique constrictions anteriorly, but at some distance from the aperture, and portions of the sutural line are preserved in places.

Two are specimens, with the test preserved on one side, collected some ten or twelve miles up the Nanaimo River by Mr. Harvey in 1901. One of these is seventy-four millimetres, or nearly three inches in its greatest diameter, the other seventy-one mm. The larger one shows a portion of a constriction, at the aperture, the smaller one no indication of any constriction, yet the latter, in shape and size, is extremely similar to a specimen from Cumshewa Inlet, in the Queen Charlotte Islands, collected by Dr. G. M. Dawson in 1878, which shows six periodic constrictions. Both show many minute oblique striæ on the side, parallel with the direction that the constrictions always take in British Columbia specimens.

The fourth is a specimen sixty-eight mm. in its maximum diameter, and showing one periodic constriction, near the aperture, collected by the Rev. G. W. Taylor, at Brennan Creek, in 1901.

In each of these Vancouver Island specimens, the outer volution is distinctly subquadrate, the sides and the siphonal and antisiphonal region being flattened.

Stoliczka (op. cit) says that it is only the young shell of *Ammonites Timotheanus* that is marked with from six to seven constrictions (junioribus 6-7 sulcatis).

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In Eastman's translation of Zittel's Text-book of Palæontology, Hyatt regards *Tetragonites* not only as a distinct genus, but as the type of a new family which he calls the Tetragonitidæ.

Pseudophyllites Indra, Forbes. (Sp.)

Ammonites Indra, Forbes. 1845. Trans. Geol. Soc. Lond., Ser. II, vol. VII, p. 105, pl. XI, fig. 7.
" " Stoliczka. 1865. Cret. Cephal. S. India, vol. I, p. 112, pl. LVIII, fig. 2.
" " Whiteaves, 1879. This volume, pt. 2, p. 107, pl. 13, fig. 2.

Lytoceras (*Pseudophyllites*) *Indra*, Kossmat. 1894. Beitr. zur. Palæont. Oesterreich-Ungarns und des Orients, vol. IX, p. 137 (41), pl. XVI (II), figs. 6 *a*, *b*, 7, 8, *a*, *b*, 9, *a*, *b*; pl. XVII (III), figs, 6, and 7, *a*, *b*; and pl. XVIII (IV), fig. 3.

A few additional specimens of this species were collected at Hornby Island, by Mr. Harvey, between the years 1890 and 1896, and determined by the writer. Most of these are now in the Provincial Museum at Victoria. Dr. Kossmat, also, says that he saw a specimen of *P. Indra*, collected at Vancouver Island, by Sir James Hector, in the Natural History Department of the British Museum at South Kensington.*

Heteroceras elongatum. (N. Sp.)

Plate 44, fig. 2.

Heteroceras Conradi, Whiteaves. 1879. This volume, pt. 2, p. 100, pl. 12; but probably not *Ammonceratites Conradi*, Morton (1839).

Shell composed of a calcareous tube, which is at first coiled in a regular elongated spiral, as in *Turrilites*, but which is ultimately free and partially uncoiled. Spiral portion either dextral or sinistral, narrowly elongated, longer than wide; volutions rounded, ventricose and inflated externally, rather obliquely coiled, in contact at the suture, but with a narrow umbilical cavity or perforation between them. Uncoiled portion and sculpture of both portions, as previously described on page 101 of the second part of this volume.

The specimens collected by Mr. Richardson, which were referred to *Heteroceras Conradi*, are very imperfect and do not shew the shape and proportions of the spire, or closely coiled portion of the shell, at all well. This feature is much better seen in two sinistral specimens from Hornby Island, collected by Mr. Harvey, in 1895, and especially in the one figured on Plate 44. The discovery of these two fossils has led to the conclusion

* Jahrbuch der K. K. Geologischen Reichsanstalt, Wien, 1894, bd. XLIV, heft III, p. 472.

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that they and the specimens collected by Mr. Richardson, are probably distinct from Morton's *Ammonceratites Conradi*, and it now seems desirable to distinguish the former by a different and new specific name.

The general contour and mode of coiling of *H. elongatum* seem to be essentially similar to those of *Heteroceras polyplocum*, Schluter, which is the type of Hyatt's recently proposed genus *Bostrychoceras*.

Mr. Harvey writes that he has collected many specimens of this species on the Puntledge, or Comox River, near Comox, V. I., a previously unrecorded locality for it.

Heteroceras Hornbyense, Whiteaves.

Plate 42, figs. 1, 2, 3 and 4.

Heteroceras Hornbyense, Whiteaves. 1895. Canad. Rec. of Sc., vol. VI, p. 316.
Heteroceras perversum, Whiteaves. 1895. Idem, p. 317. Sinistral variety.

Original descriptions:

H. Hornbyense. "Shell dextral, depressed turbinate, much broader than high, and composed, so far as is known, of five or six rounded, ventricose volutions, which are in close contact but without embracing; spire moderately elevated; umbilicus broad and deep, exposing the whole of the inner volutions.

"Surface marked with simple and not very flexuous transverse ribs. Upon the last volution one or two continuous ribs without tubercles alternate with a rib or pair of ribs which bears, or bear, a small but rather prominent tubercle on each side of the periphery. Usually two ribs coalesce, both above and below, at each tubercle, but occasionally a single thickened rib bears a pair of tubercles. In places, also, where the test is preserved, the surface is seen to be marked with fine raised lines, parallel to the ribs. Sutural line unknown.

"Maximum breadth of the outer volution of the largest specimen collected, nearly two inches and three-quarters.

"Hornby Island, W. Harvey, 1894; two specimens, one with most of three volutions, and the other with the whole of four volutions and a part of the fifth preserved."

H. perversum. "Shell sinistral, but in other respects essentially similar to that of the preceding species.

"Hornby Island, W. Harvey, 1894; a single specimen about an inch and three-quarters in its maximum diameter, with nearly the whole of one volution remarkably well preserved.

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"It is not at all unlikely that the early volutions of *H. Hornbyense* may be coiled indifferently to the right or left, and if so, that this may be a mere sinistral variety of that species."

In one of the types of *H. Hornbyense*, it may be added, the summits of many of the ribs are curiously flattened downward, and this has since been found to be quite a characteristic feature of the species.

The foregoing descriptions refer exclusively to the spirally coiled portion of the shell, the only part that was then known. Since they were written, the writer has seen a few additional specimens of the species from Hornby Island, the only locality at which it is, so far, known to occur. Two of these, which are now in the Museum of the Survey, are of special interest. One is a sinistrally coiled specimen, with a considerable portion of two and a half of the earlier volutions preserved, collected by Mr. Harvey in 1895. This specimen, the original of figure 3 on Plate 42, has convinced the writer that *H. perversum* is only a sinistral variety of *H. Hornbyense*. The other, which is represented by figure 4 on the same Plate, is by far the largest specimen that the writer has seen, and was collected by Dr. Beadnell in 1895. It is also in the Museum of the Survey, and is septate throughout. It shews that *H. Hornbyense* (like *H. elongatum*) is at first spirally coiled, but that the calcareous tube of which it is composed becomes free, deflected, and bent abruptly on itself somewhat like the anterior and terminal end of a *Hamites* or *Ancyloceras*, before the commencement of the body chamber. Unfortunately in this specimen (as in that of *H. elongatum* figured on plate 12, figs. 1 and 1*a* of the second part of this volume) the deflected part of the shell is completely broken away and entirely disconnected from the spiral portion, so that, in each case, it is difficult to get a clear idea of the exact shape of the shell before it was broken. The tubercles on each side of the periphery or venter, in this large specimen, are narrowly elongated, in a direction parallel to the ribs of which they form a part. A transverse section of the deflected portion is nearly circular in outline, and the lateral diameter of the aperture is a little over an inch and a half. Here and there small portions of the septation are exposed, but in no place can a continuous sutural line be traced.

It may be that the spiral portion of the shell is more narrowly elongated than was at first supposed, and that this species also may prove to be referable to Hyatts' genus *Bostrychoceras*.

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HAMITES OBSTRICTUS, Jimbo.

Plate 44, fig. 3.

Hamites cylindraceus? Defrance. Whiteaves. 1879. This volume, pt. 2, p. 113, pl. XIV, figs. 2 and 2 *a*; but not *H. cylindraceus* of Defrance or d'Orbigny.

Hamites obstrictus, Jimbo. 1894. Beitr. zur Kennt. der Fauna der Kreideform. von Hokkaido, in Dames and Kayser's Palæontol. Abhandl., N. Ser., vol. VI, p. 38, pl. 7 (23), figs. 2 and 2 *a-b*.

Hamites obstrictus, Whiteaves. 1896. Trans. Royal Society of Canada for 1895, Second Series, vol. I, sect. 4, p. 130.

"Posterior extremity of the shell unknown, the prolonged and reflected portions slender, straight, almost circular in outline in transverse section, unless when abnormally compressed, and separated from each other by a space about equal in width to the maximum diameter of the reflected portion, near the aperture.

"Surface marked by prominent, narrow, simple and rarely bifurcating transverse ribs, which are rounded at their summits and separated by rather deep concave furrows. Besides the ribs, or rather furrows, there is a single transverse constriction on the reflected portion of the shell. On the prolonged portion the ribs are about one millimetre apart, but on the reflected portion they are nearly two millimetres apart.

"Sutural line as represented on Plate 14, fig. 2 *a*, of the second part of" this volume.

"Sucia Islands, J. Richardson, 1874: one crushed specimen, with the sutural line well preserved. North-west side of Hornby Island W. Harvey, 1893: two good specimens, one of them apparently free from distortion. All three, upon the whole, agree remarkably well with Jimbo's description and figures of *H. obstrictus*, although in that species there are two transverse constrictions of the prolonged portion of the shell, as well as one on the reflected portion, and the lobes and saddles of its sutural line are perhaps not quite so numerously incised as those of the specimen from the Sucia Islands." (Whiteaves, 1896, op. cit. supra, pp. 130 and 131.)

Quite recently the Imperial University of Tokio, per Mr. H. Yabe, has presented to the Museum of the Survey an authentic Japanese specimen of *H. obstrictus*. This specimen, though only a cast of the interior of the shell, with no portions of any of the sutural lines preserved, seems to be essentially similar to and practically indistinguishable from, the specimen collected at the Sucia Islands by Mr. Richardson.

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Diplomoceras notabile. (N. Sp.)

Plate 44, figs. 4, 4 *a* and 4 *b*.

Shell very large when perfect, subcylindrical and transversely ribbed, ribs simple, leaving no impress upon the cast. The only specimen known to the writer is a nearly straight piece of the prolonged portion, from Hornby Island, about ten inches and three-quarters long, and septate for by far the greater portion of its length. It is slightly compressed at the sides, broadly oval and not far from circular in transverse section. Near the smaller end it measures forty-seven millimetres in its diameter from the siphonal to the antisiphonal side, and thirty-eight mm. in its lateral diameter. Near the larger end the corresponding measurements are fifty-five mm. by forty-six.

The ribs are numerous, closely and regularly disposed, nearly transverse, but slightly oblique, rounded, and about as wide as the shallowly concave grooves between them. On the middle of each side there are about eight and a half ribs to the inch near the smaller end, and seven at the larger. In addition to the ribs there are two widely distant, narrow, transverse constrictions, running parallel with them.

The sutural lines, although well preserved, and exposed over a considerable portion of the surface of one side of the specimen, are so complicated and crowded that it is almost impossible to follow any one of them quite continuously from the siphonal to the antisiphonal side. A careful study, however, show that the septation of this specimen is essentially similar to that of *Hamites cylindraceus*, as figured by d'Orbigny on Plate 136, figure 4, of the Atlas to the first volume of the "Terrains Cretaces," which is the type of Hyatts recently proposed genus *Diplomoceras*. In both there are six lobes, viz., two large laterals (the "latéral supérieur" and the "latéral inférieur" of d'Orbigny) on each side; one siphonal lobe and one antisiphonal. In both, also, the two lateral lobes, on each side, are very nearly equal in size. But the lobes and saddles of the Hornby Island specimen are still more numerously incised than are those of the French fossil, and this may be easily seen by comparing the siphonal saddle, the largest of the three accessory saddles between the first and second laterals, and the antisiphonal lobe, of both. The figure of the siphonal saddle of *H. cylindraceus* in the Atlas to the Terrains Crétacés, for example, represents it as entire at the summit and only twice incised on each side, whereas in the Hornby Island specimen, the same saddle is twice incised at the summit and four times on each side.

North-west side of Hornby Island, the specimen described and figured, which has most of the test preserved on one side, but very little on the

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other. It was collected by Captain Gardner who kindly lent it to the writer for examination and description in 1898, and since then it has been returned.

This remarkable fossil is evidently much more closely allied to the *Hamites cylindraceus* of European authors than is the small and slender specimen from the Sucia Islands that the writer once doubtfully referred to that species. The former seems to differ from *H. cylindraceus* only in its much more distinctly defined, though rather narrow, annular costæ, and in the more numerous incisions in the lobes and saddles of its sutural line. It may prove to be nothing more than a local or geographical variety of *H. cylindraceus*. D'Orbigny describes the ribs of that species by the phrase "costis simplicibus evanescentibus," and gives the length of a specimen as 320 mm., or not quite thirteen inches. Pictet, on page 99 of the second volume of the Paléontologie Suisse, says that the ribs of *H. cylindraceus* are "très effacés."

Anisoceras Cooperi, Gabb. (Sp.)

Plate 43, fig. 1.

? Ammonites Cooperi, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I., p. 69, pl. 14, figs. 23 and 23 *a*.

? Hamites Vancouvergnsis, Gabb. 1864. Idem, vol. I, p. 70, pl. 13, fig. 18.

? Hamites (? Ancyloceras) Vancouverensis, Gabb. 1869. Idem, vol. II, p. 212.

Heteroceras Cooperi (Gabb) Meek. 1876. Bull. Geol. and Geogr. Surv. Territ., vol. II, p. 367, pl. 3, figs. 7 and 7 *a*.

Anisoceras Vancouverensis, Whiteaves. 1895. Canad. Rec. Sc., vol. VI, p. 313, pl. II; and (1896) Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 131.

The name "*? Ammonites Cooperi*" was proposed by Gabb for two or three very much compressed fragments from near San Diego, the best of which is figured on Plate 14 of the first volume of the Palæontology of California. This fragment does not give the least idea of the shape of the shell, when entire, and its sculpture is thus described. "The surface is ornamented by two rows of nodes (on the side?) with ribs extending across, some passing through one, some through two of the nodes; while others originate in one and end in another. By the peculiar arrangement of the ribs, there are about a third more on the middle of the fragment than on the margins." A portion of the sutural line of this specimen is also described and figured.

In the same volume, Mr. Gabb describes and figures a specimen from Comox, which seems to have a very similar kind of sculpture, under the name *Hamites Vancouverensis*. The figure of this specimen shews one straight limb abruptly bent on itself, as in *Hamites*, but, in the second

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volume of the Palæontology of California, Mr. Gabb refers it doubtfully to *Ancyloceras*. Its surface is said to be "marked by numerous sharp ribs crossing the shell, inclined obliquely forwards; well marked, but diminished in size on the ventral side; largest laterally; each rib carrying a small flattened tubercle on the latero-dorsal angle; some ribs in the curve, on the ventral side, exhibit a tendency to tuberculation, but the shell being broken off at that point, their presence cannot be certainly determined. Interspaces between the ribs broadly concave." Its septum is said to be unknown.

Mr. Meek, in 1876, referred a large fragment from Comox, "with much doubt, to the species described by Mr. Gabb under the name *Ammonites ? Cooperi*" and describes and figures it under the name *Heteroceras Cooperi*. This fragment does not give any idea of what the shape of the entire shell was like. Its surface is said to be "ornamented by moderately distinct annular costæ, which pass around rather obliquely. Two rows of nodes also occur on the outer or dorsal side, at which points the costæ usually bifurcate."

In 1893 and 1895 a few much more perfect specimens, which the writer has identified with *Hamites Vancouverensis*, were collected at Hornby Island, and two of these were described at some length, under the name *Anisoceras Vancouverense*, in the "Canadian Record of Science," for April, 1895. In this publication the largest and most perfect of these specimens, which has since been presented to the Museum of the Survey by Mr. Harvey, is figured in outline. This specimen, it is stated, "has convinced the writer that *Hamites Vancouverensis* is a true *Anisoceras*, allied to *A. armatum*, Sowerby, but devoid of lateral tubercles, also that the fragment from Comox described and figured by Meek as *Heteroceras Cooperi*, is probably a small piece of the abruptly bent part of *Anisoceras Vancouverense*. "A similar fragment," now in the Survey collection, "was collected quite recently by Mr. Harvey at Hornby Island. "It is most likely also that the fragments of the shell of a cephalopod from the Chico group of California, for which Gabb proposed the name *Ammonites Cooperi*, are distorted pieces of *A. Vancouverense*, and if that be the case the laws of priority may require that the species shall be called *Anisoceras Cooperi*, Gabb, (sp.), as the description of Gabb's *Ammonites Cooperi* immediately precedes that of his *Hamites Vancouverensis*." On the "similar fragment" from Hornby Island, referred to in the foregoing quotation, the tubercles or nodes on each side of the venter are so prominent, conical and pointed as to suggest the idea that they are spine bases.

Since the paper in the "Record" was written, the writer has seen three additional specimens of this species from Hornby Island, two of which have been presented to the Survey Museum. One of these is the beauti-

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ful fossil figured on Plate 43, which was collected by Mr. F. W. Robbins in 1893. Another is a well preserved example of an unusually small variety of the species, collected by Dr. Beadnell, and presented to the Harrogate Museum in England. Through the liberality of the authorities and members of that institution, however, and with Dr. Beadnell's consent, this interesting and in its way unique specimen has been permanently transferred to the Survey collection. It is imperfect at both ends, and measures not quite three inches and a half in its greatest length, by about two inches in its maximum breadth. At the end the farthest removed from the bend, the distance between the two limbs is not more than five millimetres. On the prolonged limb the ribs are unusually fine and numerous, but on the anterior portion of the reflected limb, and especially near the aperture, they rapidly become more distant and less numerous. At the smaller end of the prolonged limb a small portion of the septation is exposed, but no considerable portion of a continuous sutural line can anywhere be traced. No other specimen that the writer has seen, shews any vestige of the septation.

ANISOCERAS SUBCOMPRESSUM, Forbes. (Sp.)

Plate 45, figs. 1, 1 *a*, and 1 *b*.

Hamites subcompressum, E. Forbes. 1845. Trans. Geol. Soc. Lond., Second Series, vol. VII, p. 116, pl. XI, fig. 6.

Anisoceras Indicum, Stoliczka (1865) non Forbes. Cret. Cephal. S. India, vol. I, p. 181, pl. LXXXV, figs. 1–5.

Hamites (Anisoceras) subcompressum (Forbes) Kossmat. 1894. Beitr. zur. Palæont. Oesterreich-Ungarns und des Orients, bd. IX, p. 145 (49), pl. XIX (V), figs. 10, *a-b*, 11 *a-b*, and 12.

Trent River, V.I., below the Falls, J. Richardson, 1872: one specimen. Puntledge or Comox River, near Comox, V.I., W. Devereux, 1890, the specimen figured; and S. J. Cliffe, 1893 (?), one specimen; the property of the Provincial Museum at Victoria, V.I.

The most perfect of these, the specimen figured, is at first coiled in an irregular, loose, open spiral, but it rapidly straightens out afterwards towards the aperture. It consists of rather more than one volution, which is not coiled upon quite the same plane, its earliest portion being curved a little to one side. In the specimen from the Trent River, however, the straighter anterior portion is a little twisted laterally. The surface of all the specimens is marked by thin, sharp and simple transverse ribs, with concave grooves between them. In most of the specimens the ribs are somewhat distant over the whole of the surface, but in the specimen figured they are comparatively close together posteriorly. Septum unknown.

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These specimens can scarcely be satisfactorily distinguished from the *Anisoceras* which Stoliczka describes and figures under the name *A. Indicum* in the "Palæontologia Indica," but which Kossmat says is the *Hamites subcompressus* of E. Forbes. Dr. Kossmat, who has kindly compared two of those from Comox with Indian specimens, has come to the same conclusion. "The specimens from Vancouver," he writes, "agree, when adult, in all features with Forbes' *H. subcompressus*, but in young stages their section is almost circular, whilst the true *H. subcompressus* has in all stages a compressed, oval section. "The Vancouver specimens, therefore, are, to a certain extent, intermediate between *H. Indicus* and *H. subcompressus*, but are more connected with the latter. They seem, also, to have some constrictions, which are a common feature of *H. subcompressus*."

Baculites Chicoensis, Trask.

Baculites Chicoensis Trask. 1856. Proc. San Francisco Acad. Nat. Sc., p. 85, pl. 2, fig. 2.
Baculites ovatus (Say?) Meek. 1857. Trans. Albany Inst., vol. IV, p. 48.
Baculites inornatus, Meek. 1861. Proc. Acad. Nat. Sc. Philad., vol. XIII, p. 16.
Baculites occidentalis, Meek. 1861. Idem. p. 16.
Baculites Chicoensis, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 80, pl. 14, figs. 27, 29 and 29 *a*; and pl. 17, figs. 27 and 27 *a*.
" " Meek. 1876. Bull. Geol. and Geogr. Surv. Terr., vol. II, p. 364, pl. 4, figs. 2 and 2 *a*, *b*, *c*.
Baculites occidentalis, Meek. 1876. Idem. p. 366, pl. 4, figs. 1, 1 *a*, *b*.
Baculites Chicoensis, Whiteaves. 1879. This volume, pt. 2, p. 114.
Baculites occidentalis, Whiteaves. 1879. Idem, p. 115.
Baculites Chicoensis, C. A. White. 1889. Bull. U.S. Geol. Surv., No. 51, p. 47.

Since the second part of this volume was written, the writer has seen a few additional specimens of *Baculites* collected at Comox by Lady Douglas in 1889, at Hornby Island by Mr. Harvey in 1894, and at the Sucia Islands by Dr. Newcombe in 1894. These are here referred to *B. Chicoensis*, in accordance with the opinion expressed by Dr. C. A. White in 1889 (op. cit. supra), in which the writer fully concurs, that he has "much doubt whether there is more than one species of *Baculites* in the Vancouver group."

Hoplites Vancouverensis, Meek. (Sp.)

Ammonites Vancouverensis, Meek. 1861. Proc. Acad. Nat. Sc. Philad., vol. XIII, p. 317.
Placenticeras Vancouverense, Meek. 1876. Bull. Geolog. and Geogr. Surv. Terr., vol. II, p. 370, pl. 6, figs. 1, 1 *a-c*.
Ammonites Vancouverensis, Whiteaves. 1879. This volume, pt. 2, p. 103.
Hoplites Vancouverensis, Whiteaves. 1893. Trans. Royal Soc. Canada for 1892, vol. X, sect. IV, p. 118.

A few specimens of this shell were collected at the Sucia Islands by Dr. C. F. Newcombe in 1894 and 1896.

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Genus PACHYDISCUS, Zittel (1884).

A. Normal forms, in which the cast of the interior of the shell is uniformly devoid of transverse and periodic constrictions.

PACHYDISCUS OTACODENSIS, Stoliczka. (Sp.)

Plate 46, fig. 1.

Ammonites Otacodensis (pars) Stoliczka. 1865. Cret. Cephal. S. India, vol. I, p. 169, pl. LIV, figs. 3 and 4, and pl. LVI (but not pl. LVII); fide Kossmat.

Pachydiscus Otacodensis, Kossmat. 1894. Jahr. K. K. Geol. Reichsanstalt Wien, vol. 44, p. 472.

Pachydiscus Otacodensis, Whiteaves. 1896. Trans Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 131.

Pachydiscus Otacodensis, Kossmat. 1897. Beitr. zur Palæont. Oesterreich-Ungarns und des Orients, p. 98 (163, pl. XVI (XXII), figs. 1 *a* and 1 *b*; and pl. XVII (XXIII) fig. 1.

Two specimens from the Vancouver Cretaceous have been identified with this Indian species by Dr. Kossmat. One of these, which the writer has not seen, is said to be a fine specimen collected at Nanaimo, V. I., by Sir James Hector (presumably in 1860) and now in the Natura History Department of the British Museum. The other, No. 14 of the small series of Ammonites sent to Dr. Kossmat, and the original of figure 1 on Plate 46, is a well preserved specimen collected at Hornby Island, by Mr. F. W. Robbins, in 1895, and presented by him to the Museum of the Survey. It measures about five inches and a half in its greatest diameter, and its aperture is higher than wide, elliptic subovate, but deeply emarginate by the encroachment of the preceding volution.

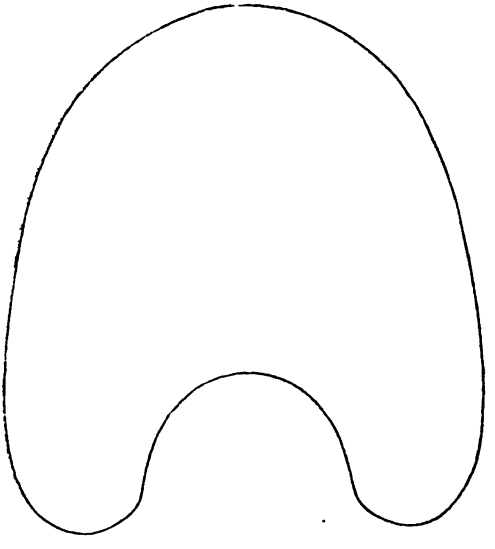

FIG. 20.—*Pachydiscus Otacodensis.* Outline of transverse section of the outer volution, near the aperture, of the specimen from Hornby Island represented on Plate 46.

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Its umbilicus, which is rather deep and step-shaped, has a rounded margin, and occupies about one-fourth of the whole diameter. On the outer volution the surface markings consist of distant, narrow, low and rather flexuous, transverse ribs, which become fainter with age and are almost obsolete near the aperture. On the periphery or siphonal region, at a short distance from the aperture, six of the ribs are from nine and a quarter to twelve and a quarter millimetres apart. The spaces between these ribs are comparatively broad and nearly flat, and where the test is preserved, the interspaces are marked with a few obscure minute transverse riblets, or small, faint, rounded and very slightly raised ridges, that are parallel to the ribs.

In the Museum of the Survey there are four other specimens, which, in the writer's judgment, possess essentially similar characters, and therefore are probably also referable to *P. Otacodensis*. Three of these are from the Comox River, near Comox, V.I., collected by Mr. Harvey in 1893; and one from Hornby Island, collected by Mr. Harvey in 1895.

The figured specimen presented by Mr. Robbins, has been examined by Dr. Kossmat, who has forwarded the following notes in regard to it. "No. 14 agrees in all essential characters with the types of *P. Otacodensis* found near Otacod in the collection of Mr. Worth. Sometimes the umbilical wall of the Indian specimens is somewhat higher than in No. 14, but this character is variable, and I have before me, also, shells which agree in this feature with your specimen. The ribs of No. 14 fade off near to the umbilical wall, whilst in most of the Indian specimens they reach down only to the middle parts of the sides; but I have seen in the Hector collection, a Canadian specimen, (mentioned in my paper in the Jahrbuch K. K. Geol. Reichsanstalt) showing the same style of sculpture as the Indian specimens, and there are, on the other hand, individuals of otherwise typical *P. Otacodensis*, with relatively long ribsc which also disappear near the umbilical wall, so that there is no specific difference between the specimen from Vancouver and *P. Otacodensis*.

"The only difference, which seems to be constant, is the following: on *P. Otacodensis* the ribs of the external region are relatively closely arranged in young and old stages, whilst in a middle stage, (when about 6 or 7 cm. in diameter) the distance of the ribs apart is about 1 to 1½ cm. (sometimes even more) while in the Canadian specimen the distance is never so great. But I cannot think that this can be considered as of specific value, though perhaps it might be desirable to regard the Vancouver form as a local variety. The septa agree perfectly in the arrangement of saddles and lobes, and in every detail. Plate LVI in Stoliczka's work represents a specimen with relatively coarse ribs, but, as

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a rule, the ribs on the outer volution are not more developed than on the Canadian specimen No. 14."

Pachydiscus Neevesii. (N. Sp.)

Plate 47, fig. 1.

Shell compressed convex and rather narrowly umbilicated, volutions somewhat closely convolute, a little more than half of the inner ones being

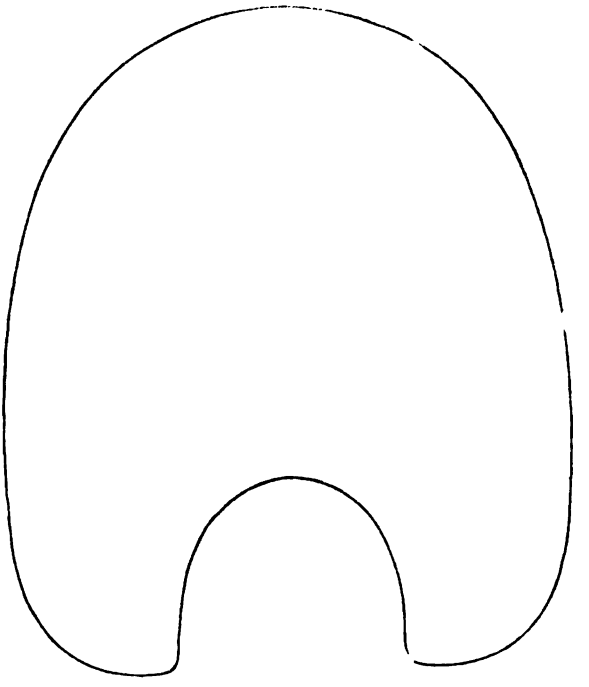

Fig. 21.—*Pachydiscus Neevesii.* Outline of transverse section of the outer volution, near the aperture, of the specimen from James Island represented on Plate 47.

covered by those that succeed them; umbilicus occupying one-fourth of the entire diameter, its margin rounded and its inner wall rather steep. Aperture higher than wide, broadly subelliptical, but rather deeply emarginate by the encroachment of the preceding volution.

Surface of the outer volution marked with numerous, very slightly elevated, gently flexuous, transverse ribs, which are everywhere much narrower than the very shallowly concave or nearly flat spaces between them. On the periphery and near the aperture of the specimen figured the ribs average from two to three millimetres in breadth, and from

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seven to ten (but exceptionally sixteen) mm. apart at their summits. Most of these ribs are simple and continuous, from the umbilical margin on one side to that on the other, but they occasionally almost bifurcate or trifurcate at or near the umbilical margin, and a few shorter ribs are here and there intercalated between the longer ones, where one or more faint and obscure minute riblets can also be detected. On each side of this volution and especially near the aperture, some of the longer ribs are strongly flattened downward at their summits, and widened, sometimes for quite a long distance, longitudinally. On the inner wall of the umbilicus all the ribs are obsolete, and its surface consequently is quite smooth.

Sutural line not well seen, but apparently very similar to that of *P. Otacodensis.*

The largest and best specimen known to the writer, the one figured, is septate throughout, though most of the sutures are either covered by the test, or so badly worn by exposure, that their finer details are completely obliterated. Its dimensions are: maximum diameter, 191 millimetres (or 7½ inches); greatest breadth, 75 mm. (or 3 inches); width of umbilicus, about 47½ mm.

James Island, north of Victoria, V.I., Mr. Fred. Neeves, January, 1888: the fine specimen figured, which has most of the test preserved and upon which the preceding description was based. It was kindly lent to the writer by the Natural History Society of British Columbia.

A crushed and distorted but testiferous specimen, some three inches and a half in its greatest diameter, collected by Mr. A. Raper in 1893 from the Vancouver Coal Company's No. 1 shaft, at Nanaimo, and presented by him to the Provincial Museum at Victoria, is probably referable to this species. Its outer volution is marked by about thirty narrow, transverse but slightly flexuous, simple ribs, with broad flat spaces between them. Some of these ribs extend to the umbilical margin, but others not quite so far.

Hornby Island, W. Harvey (1893, 1894 or 1895): a well preserved specimen, a little more than six inches in its greatest diameter, of a variety of this species in which the ribs are nearly obsolete anteriorly, the outer half of the last volution being almost or quite smooth. This specimen is the property of the Provincial Museum at Victoria.

Sucia Islands, J. Richardson, 1874: a large and well preserved fragment, consisting of about half of one volution, which is not quite four inches and a half in length, by about two and a half in breadth.

P. Neevesii, apparently, has much more numerous and more closely disposed ribs than *P. Otacodensis*, and the outer volution of the former is

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more compressed laterally. The fragment of a whorl from the Cretaceous rocks of Saghalien (Sachalin) that Friedrich Schmidt figures under the name *Ammonites planulatus*, * has a very similar kind of ribbing to that of *P. Neevesii*, but the Saghalien specimen is marked also with distinct and distant, periodic constrictions. Dr. Kossmat, who has examined the Sucia Island fragment of *P. Neevesii*, and a good photograph of the James Island specimen, writes that he knows no species with which they could be united.

Pachydiscus Suciensis, Meek. (Sp.).

Ammonites complexus, var. *Suciaensis*, Meek. 1861. Proc. Acad. Nat. Sc. Philad., vol. XIII, p. 317.

Ammonites Brewerianus, Gabb (pars). 1864. Geol. Surv. Calif., Palæont., vol. I, pl. XXVII, figs. 199 and 199 *b*, *c*; and pl. XXVIII, fig. 199 *a*.

Ammonites complexus? var. *Suciaensis*, Meek. 1876. Bull. Geol. and Geogr. Surv. Terr., vol. II, p. 369, pl. V, figs. 2 and 2 *a*, *b*, *c*.

Ammonites complexus, var. *Suciensis*, Whiteaves (pars). 1879. This volume, pt. 2, p. 106; but only the specimen referred to on p. 107, as No. 1, and perhaps that referred to as No. 2.

The original types of *A. complexus*, var. *Suciaensis* are from the Sucia Islands, and Comox, V.I., where they appear to have been collected by Mr. George Gibbs in 1858.

In the second part of this volume, on pages 107 and 108, six of the specimens collected by Mr. Richardson were identified with this species. Of these, No. 1 is clearly a typical specimen of *P. Suciensis*. It is a well preserved cast of the interior of the shell, nearly four inches in its greatest diameter, from the Sucia Islands. No. 2 is a cast of the interior of the outer volution of a large specimen of a species of *Pachydiscus*, from North West Bay, Vancouver Island. Its shape and sculpture are very similar to those of *P. Suciensis*, but its ribs are much more prominent proportionately, though perhaps not more so than would be consistent with its being a well marked variety of that species. Nos. 3, 4, 5 and 6, from the Trent River, V.I., are probably distinct from *P. Suciensis*. Dr. Kossmat, who has seen one of the best of these four specimens, thinks that it may possibly be referable to *P. Newberryanus*, but in each of the four the outer volution is subglobose and much more convex. Outside of the emargination caused by the encroachment of the previous volution, the aperture of these Trent River specimens is wider than high, whereas that of *P. Newberryanus* is much higher than wide. At one time the writer thought that Nos. 3, 4, 5 and 6 were conspecific with the *Ammonites Arrialoorensis* of Stoliczka (erroneously called *A. Deccanensis* on Plate

* On Plate 1, figs. 5 to 7, of volume XIX, of the Mémoires de l'Academie Imperiale des Sciences de St. Pétersbourg, Seventh Series, 1873.

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LXIV, fig. 1, of the Cretaceous Cephalopoda of Southern India), but it would now seem that the former are marked with a few distant periodic constrictions as well as ribs, and that the latter is not.

The large specimen figured by Mr. Gabb, as *Ammonites Newberryanus*, on Plates 27 and 28 of the first volume of the Palæontology of California, which he said he obtained on Vancouver Island in the fall of 1863, is now in the Museum of the Academy of Natural Sciences of Philadelphia, and has been kindly lent to the writer, for study, by Dr. H. A. Pilsbry. An actual examination of this specimen has corroborated the view expressed in the second part of this volume that it should be referred, not to *P. Newberryanus*, but to *P. Suciensis*. In this and other specimens of *P. Suciensis* the low, distant ribs are often curiously flattened downward at their summits, for some length on the periphery or siphonal region, but not on the sides.

Several typical and characteristic examples of *P. Suciensis* were collected at Hornby Island, by Mr. Harvey, in 1895 and 1896, and four of these are now in the Museum of the Survey. An unusually fine specimen of the same species, about six inches in its maximum diameter, collected at the Sucia Islands, by Dr. Newcombe, in 1896, and now the property of the Provincial Museum at Victoria, has also been lent to the writer for examination. It shews all the details of the siphonal and first and second lateral lobes and saddles excellently, and has a small portion of the test preserved.

PACHYDISCUS HARADAI, Jimbo.

Pachydiscus Haradai, Jimbo. 1894. Beitr. zur Kenntniss der Fauna der Kreideform, von Hokkaido, in Dames and Kayser's Palæontologische Abhandl., Neue Folge Band II, Heft 3, p. 29, Taf. II, (XVIII) figs. 2, 2*a*, *b*.

" " Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, p. 132, pl. III, fig. 6.

"Nanaimo River, ten miles from its mouth, A. Raper, May, 1893: a fine specimen about six inches in its maximum diameter, which agrees remarkably well with Jimbo's description and figures of *P. Haradai*." "Its volutions are compressed at the sides, the periphery is regularly rounded, and the umbilicus occupies rather less than one-third of the entire diameter. There are eleven large continuous and distant ribs on the outer volution, with from one to four rather smaller and shorter ribs between them, and the intervals between all of them are finely and transversely striated." (Whiteaves, 1896, op. cit. supra.)

The Japanese type of *P. Haradai* is described as measuring 160 mm. (or 6⅔ inches) in its greatest diameter, and as being marked by about eleven long ribs, bearing a single elongated tubercle on the umbilical

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margin on both sides, and with one to three shorter ribs between each pair of the longer ones. In the figure of this specimen, however, the tubercles are represented as obscure and ill defined on some of the ribs and as quite obsolete on the others.

PACHYDISCUS (HARADAI? var.) PERPLICATUS.

Plate 48, fig. 1.

Shell apparently very similar to that of *P. Haradai* in general form, but with its surface marked by much larger and more prominent transverse ribs, or coarse rib-like folds, with more deeply concave grooves between them. The only specimen that the writer has seen is a well preserved cast of the interior of the shell of a specimen, with a little more than the whole of one side worn away, except at A, where part of the siphonal region is preserved. The portion that remains is about six inches and a half in its greatest diameter, and the specimen, when entire, was probably rather more than seven inches in diameter. Its outer volution is marked by fourteen long and slightly flexuous, simple ribs, or rib-like folds, with usually one, but occasionally two, shorter ribs intercalated between each pair of the longer ones. These latter are narrowest, most prominent and abruptly truncated at the umbilical margin, but broader and not so prominent on the periphery. The six nearest to the aperture average from a little less than an inch to an inch and a quarter apart, measuring from the middle of their summits and near to the periphery. Septation unknown.

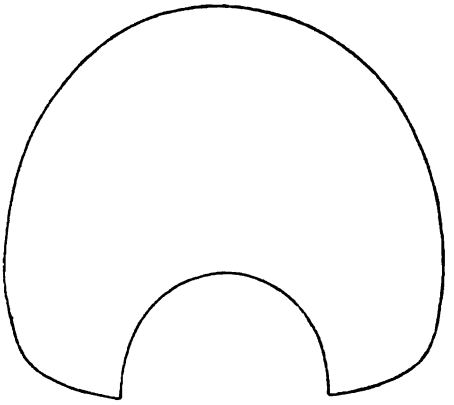

FIG. 22.—*Pachydiscus (Haradai? var.) perplicatus.* Outline of transverse section of the outer volution, at A, the only place where any part of the siphonal region is preserved, and *between the ribs*, of the specimen from the Comox River represented on Plate 48.

Comox River, near Comox, V.I., J. R. Bennett, 1896 : one specimen, which he has kindly presented to the Museum of the Survey.

Some of the long ribs seem to bear a low, conical, and transversely elongated tubercle on the umbilical margin, but this appearance is partly

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due to the abrupt truncation of the ribs there. It is doubtful whether this specimen should be regarded as a well marked variety of *P. Haradai*, or as the type of a distinct and previously undescribed species.

Pachydiscus binodatus. (N. Sp.)

Plate 49, figs. 1, & 1*a*.

Shell strongly ribbed and moderately inflated, but depressed in the middle on both sides, the umbilicus occupying a little more than one third of the entire diameter, though its margin is rounded and indistinctly defined. Volutions rather closely involute, more than one half of the inner ones being covered by those which succeed them, increasing rapidly in size, the outer one rounded between the ribs and near the aperture, but subpentagonal upon the ribs, where the siphonal region is broadly flattened, and the sides slightly and somewhat obliquely compressed. Between the ribs, and near the aperture, the outline of a transverse section of the outer volution is not far from circular, but wider than high, and concavely and rather deeply emarginate by the encroachment of the preceding volution; but if taken at the ribs the section is more nearly pentagonal.

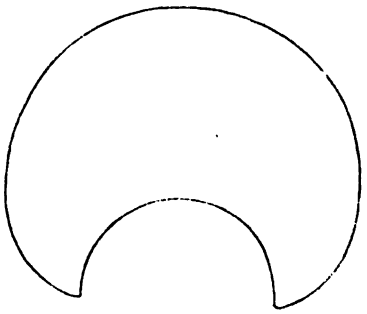

Fig. 23.—*Pachydiscus binodatus.*—Outline of transverse section of the outer volution, *between the ribs* and not far from the aperture, of the specimen from the Comox River, represented on Plate 49.

Surface of the outer volution marked by rather distant, usually simple, but sometimes bifurcating longer ribs which are prominent and concavely curved on the sides, but feebly developed, almost obsolete and nearly straight in the flattened siphonal region, at least near to the aperture. All of these longer ribs extend to, or commence at, the umbilical margin, and alternate with one or two shorter ones. On the outer portion of the last volution each rib bears two large obtusely conical nodes, one on each side of the periphery or venter, at the ventrolateral angle.

Sutural line apparently like that of a typical *Pachydiscus*, as figured by Zittel in the second volume of his Handbuch der Palæontologie.

Comox River, near Comox, V.I., W. Harvey, 1893: a well preserved cast of the interior of the shell, about four inches in its maximum diameter, the property of the Provincial Museum at Victoria.

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been collected at the Sucia Islands by Mr. Richardson, Dr. Newberry and Dr. Newcombe. The largest specimen in the Museum of the Survey is eighteen inches across, as already stated, on page 110 of this volume.

Dr. Kossmat writes that the septa of *A. Newberryanus* are "certainly not the septa of a *Desmoceras*." and adds that the specimens from Cumshewa Inlet, in the Queen Charlotte Islands, originally referred to *Ammonites Beudanti* on page 205 of this volume, and subsequently called *Desmoceras (Puzosia) Dawsoni* on page 286 of the same volume, are typical examples of the genus. But, in the second volume of his "Handbuch der Palæontologie" all that Zittel says of the sutural line of *Pachydiscus* is, that it is only a little less finely incised than that of *Haploceras* or *Desmoceras*. And, it would be difficult to find an Ammonite that has a more finely or more frequently incised sutural line, than *Pachydiscus Suciensis*.

As already stated, on pages 344 and 345, it is probable that the four Ammonites from the Trent River, collected by Mr. Richardson, and referred to on page 208 of this volume as *Ammonites complexus*, var. *Suciensis*, specimens Nos. 3, 4, 5 and 6, may rather indicate an unusually globose or subglobose form of *P. Newberryanus*.

2.—Abnormal form, in which there are no periodic constrictions on the cast of the interior of the shell.

Shopland, near Maple Bay, Cowitchan district, about thirty miles south of Nanaimo, V.I., a well preserved and nearly perfect cast of the interior of the shell, about ninety-eight millimetres or nearly four inches in its greatest diameter. On the outer volution of this specimen thirteen of the ribs are rather larger, more prominent, and longer than the rest, and between each pair of the larger ribs there are from one to four smaller ones. Two similar but not quite so well preserved specimens in the Museum of the Survey were collected on the Nanaimo River by Mr. Harvey in 1901, but one of these shows two periodic constrictions at a short distance from the aperture.

Pachydiscus multisulcatus. (N. Sp.)

Plate 50; the only figure.

Shell inflated, but very slightly compressed at the sides; umbilicus occupying about one-third of the entire diameter, its margin rounded and its inner wall rather steep. Volutions increasing rather rapidly in size, somewhat closely embracing, about one-half of each of the inner ones being covered; aperture nearly as wide as high, widely subovate, but concavely emarginate by the encroachment of the preceding volution.

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Surface marked with comparatively distant, large and prominent, but rather narrow, subangular, more or less acute and slightly flexuous transverse ribs, of unequal length also by a few transverse constrictions, representing periodic arrests of growth. The longer ribs, which extend on both sides to the umbilical margin, often bifurcate at about the middle of each side, but some of them are simple. On the outer volution of the best specimen known to the writer, there are twenty-six of these longer

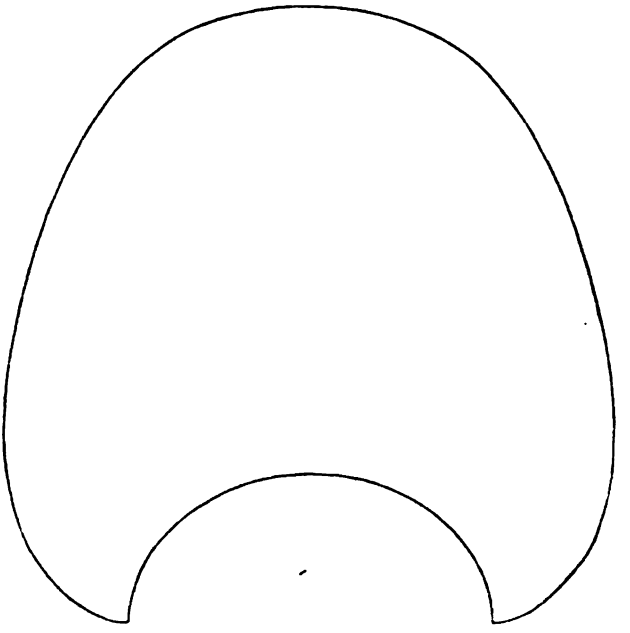

FIG. 24.—*Pachydiscus multisulcatus.* Outline of transverse section of the outer volution, between the ribs and near the aperture, of the specimen from North West Bay, V.I., represented on Plate 50.

ribs, and six or seven periodic constrictions. A single shorter rib is usually intercalated between each pair of the longer ribs, but in one place there are three of the shorter ribs between two of the longer ones. All the ribs are separated by widely concave grooves, and on the periphery of the specimen figured, between the last pair of constrictions, the ribs average from eleven to fourteen millimetres apart, at their summits. The periodic constrictions are not very conspicuous, but are usually a little deeper than the ordinary grooves between the ribs.

Sutural line unknown, only a small part of the septation being visible in either of the specimens known to the writer.

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Among the specimens that were referred to *Ammonites Newberryanus* in the second part of this volume, two of the ten from North West Bay, V. I., that were collected by Mr. Richardson in 1873, are said (on page 110) to "differ from the rest in some rather important particulars." One of these specimens, the original of the figure on Plate 50, measures about seven inches and a half in its maximum diameter. It is almost perfect and fairly well preserved on one side, but badly water worn on the other. The other specimen is a large water worn fragment with the finer details of most of its surface ornamentation completely obliterated. The more perfect of these two specimens, at any rate, seems to differ from *P. Newberryanus*, not only in its more inflated volutions, but more particularly in its higher ribs, with much broader grooves between them. Dr. Kossmat, who has seen a good photograph of this specimen, thinks that it belongs to a species allied to *P. Newberryanus*, from which it differs in "its smaller degree of involution (only one half) and the less numerous and more prominent ribs." Judging from the photograph, he adds, "it seems to me that the constrictions are more strongly bent forward than the ribs behind them, so that they have the tendency to cut off one of the ribs. This character is not observed in *P. Newberryanus*." Quite recently, in October, 1901, an imperfect but characteristic specimen of this species, about five inches in its greatest diameter, was collected two miles and a half up the Nanaimo River, V.I., by Mr. Harvey.

Desmoceras Selwynianum, Whiteaves.

Ammonites Selwynianus, Whiteaves. 1879. This volume, pt. 2, p. 104, pl. 13, figs. 1, and 1*a*.
Desmoceras Selwynianum, Kossmat. 1897. Beitr. zur Palæont. Oesterreich-Ungarns und des Orients, vol. xi, p. 148.

Sucia Islands, Dr. C. F. Newcombe, 1894: two specimens. West side of Denman Island, half a mile south of Village Point, W. Harvey, 1896: two small specimens, the largest not quite forty-nine millimetres, or nearly two inches in it greatest diameter.

One of the original types of *Ammonites Selwynianus*, from the Sucia Islands, has been kindly compared by Dr. Kossmat with Indian specimens of *A. diphylloides*, Forbes, of which it was thought possible that it might be a variety. In regard to this specimen, Dr. Kossmat wrote as follows:—"*A. Selwynianus* is a near ally of the S. Indian *A. diphylloides*, which is clearly a *Desmoceras*, as shown by its septa. Allied species of *Desmoceras* occur in Europe also, for example *D. pyrenaicum*, Grossouvre (Ammonites de la Craie Superieure, Paris, 1893, pl. xxxvii, fig. 9), in the Senonien of France. The septa can only partially be seen on the specimen sent by you, but they are certainly very similar to those of *D. diphylloides*. An important difference between the two species is the very

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narrow tongue-like process of each constriction, on the external side of *A. Selwynianus*. In *A. diphylloides* these processes are much more rounded." These conclusions, it will be seen, are essentially similar to those previously arrived at by the writer in 1879, and expressed on page 105 of this volume.

Pleuropachydiscus Hoffmannii (Gabb). Var.

Ammonites Hoffmannii, Gabb. Var. 1869. Geol. Surv. Calif., Palæont., vol. II, p. 131, pl. 20, figs. 8 and 8 *a*.
Desmoceras Hoffmannii, Stanton. 1897. Journ. Geol. Chicago, vol. v, pp. 597 and 598.
Pleuropachydiscus Hoffmanni, Hyatt. 1900. In Eastman's transl. of Zittel's Text Book of Palæontology.

A well preserved and testiferous fragment of an Ammonite collected at the Sucia Islands by Dr. Newcombe in 1896, seems to be identical with the variety of *A. Hoffmannii*, from Cottonwood Creek, that Gabb describes on pages 131 and 132 of the second volume of the Palæontology of California, and figures on Plate 20 of that volume, though it is not very much like the typical form of that species. In the Sucia Island fragment the volution is not quite so wide as high, and the surface ornamentation consists of very small, flexuous, transverse ribs, with a comparatively large rib interposed at distant intervals. Between two of these larger ribs there are about twenty-five of the smaller.

Hauericeras Gardeni (Baily).

Ammonites Gardeni, Baily. 1855. Quart. Journ. Geol. Soc. London, vol. II, p. 456, pl. II, fig. 3.
" " Stoliczka. 1865. Cret. Cephal. S. India, p. 61, pl. 33, fig. 4.
" " Whiteaves. 1879. This volume, pt. 2, p 102.
Desmoceras Gardeni, Zittel. 1884. Handbuch der Palæont., Band II, p. 466.
" " Yokoyama. 1890. Versteiner. aus der Japanische Kreide, Palæontographica, vol. XXXVI, p. 184, pl. XX, figs. 10, *a*, *b*, *c*.
Desmoceras (Hauericeras) Gardeni, Kossmat. 1897. Beitr. zur Palæont. Oesterreich-Ungarns und des Orients, vol. XI, p. 123, pl. XVIII, figs. 7, 8 and 10.

Puntledge or Comox River, at Comox, V.I., Dr. C. F. Newcombe, 1892, two specimens, one of them a well preserved cast of the interior of the chamber of habitation; and J. B. Bennett, 1894 or 1895, four specimens. Trent River, V.I., W. Harvey, 1896, one specimen and a fragment; Nanaimo River, W. Harvey, 1901, two specimens; all determined by the writer.

Of two of these specimens from Comox, Dr. Kossmat wrote as follows: "The Vancouver specimens of *D.* (*H.*) *Gardeni* agree perfectly with the

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S. African types and the S. Indian specimens compared by me. Section, sculpture, involution, constriction, sutural line, are quite the same in all. The body-chamber which you have sent is distinguished by its very deep constriction (quite similar, deep constrictions are visible in S. African specimens although they are not figured) and by its narrow mouth."

H. Gardeni is now known to occur in the Upper Cretaceous rocks of Japan. It had previously been collected from rocks of the same age in Natal, Southern India, and Vancouver Island.

GASTEROPODA.

CYLICHNA COSTATA, Gabb.

Cylichna costata, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 143, pl. 21, fig. 107.

In 1901, a few specimens that are probably referable to this species were collected at Brennan Creek, near Wellington, by the Rev. G. W. Taylor, and from the roof of the coal at the New Vancouver Coal Co's. mine, Nanaimo, by Mr. Harvey. These specimens may be described as follows:

Shell small, subcylindrical, narrowly elongated and nearly twice as long as broad, when full grown; spire sunk, its position indicated by a deep, narrow pit; aperture rather narrow posteriorly, wider anteriorly; posterior end of the outer lip projecting slightly beyond that of the previous volution and very narrowly rounded at its junction with the columellar lip.

Test thin, surface smooth and polished, but encircled with numerous revolving incised lines or minute linear spiral grooves, which are usually much narrower than the spaces between them. Under a rather powerful simple lens, each of these incised lines is seen to consist of a single, regular row of minute punctures, like those represented by figure 8*b*, on Plate 16, of the second part of this volume, and the whole of the rest of the surface to be still more minutely and longitudinally striated.

Approximate dimensions of the largest specimen that the writer has seen: maximum length, not quite nine millimetres; greatest width, five mm.

These specimens have the same kind of sculpture as those referred to on page 132 of the second part of this volume, with a query, as possibly a variety of *Bulla Hornii*, Gabb, under the name *Haminea Hornii*, but the former are much more narrowly elongated.

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It is possible, also, that the specimens collected by Mr. Richardson, at Blunden Point, V.I., and at Hornby Island, that were doubtfully referred to *Bulla Hornii*, may rather be referable to *Cylichna costata*. Those from Admiralty and the Sucia Islands, collected also by Mr. Richardson, are, however, shorter and wider in proportion to their length, and these are very similar to *Bulla Hornii*, as figured by Gabb, much more so than figure 8, on Plate 16, of the second part of this volume would leave one to infer. It is not at all likely that Gabb's typical *B. Hornii* is a true *Bulla*, as that genus is now restricted. The specimens from the Admiralty and Sucia Islands that have been identified therewith may be referable to *Cylichna* rather than to *Haminea*, and may indeed prove to be only a short and wide form of *C. costata*.

Cinulia obliqua, Gabb.

Cinulia obliqua, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. 1, p. 111, pl. 19, figs. 64, and 64 *a*, *b*, *c*.
" " Whiteaves. 1879. This volume, pt. 2, p. 131.
" " White. 1889. Bull. U.S. Geol. Surv., No. 51, p. 45.

Specimens which are obviously referable to this common species were collected at the Sucia Islands by Dr. Newcombe in 1894 and 1896; at Brennan Creek, V.I., by the Rev. G. W. Taylor in 1901; and on the Nanaimo River, two and a quarter to ten or twelve miles from its mouth, by Mr. Harvey in 1901.

Trochactæon semicostatus. (N. Sp.)

Plate 44, fig. 5.

Shell very small, narrowly subovate or ovately subcylindrical, fully twice as long as wide, with a short, angularly step-shaped spire, and narrowly rounded base. Spire composed of four volutions; outer volution shouldered above, widest at and for a short distance below the shoulder and narrowing gradually into the narrowly rounded or somewhat pointed base, or termination anteriorly.

Surface marked with numerous minute and close-set ribs, that cross the volutions transversely but become obsolete at the base of the outer volution. These ribs can only be seen with the aid of a lens, and are merely indicated in the figure.

Roof of coal, New Vancouver Coal Co.'s mine, Nanaimo, V.I., W. Harvey, 1901: six fairly well preserved but imperfect or distorted specimens, the largest of which is not quite six millimetres long.

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This is a much smaller species than the *T. cylindraceus?* (or *T. Skidegatensis*) of the Cretaceous rocks of the Queen Charlotte Islands, with a distinctly step-shaped spire, and very minute ribs that evanesce on the outer volution anteriorly.

Zittel, in his 'Handbuch der Palæontologie,' regards *Trochactæon*, Meek, as a synonym of *Actæonella*, d'Orbigny, and Dr. Paul Fischer, in his Manuel de Conchyliologie, says that it indicates a mere section of that genus.

Surcula (raricostata? var.) Hornbyensis.

Surcula raricostata, Gabb, var. Whiteaves. 1879. This volume, pt. 2, p. 116, pl. 15, figs. 2 and 2 *a*.

The five specimens from Hornby Island that are referred to in the second part of this volume as a variety of *S. raricostata*, are probably distinct therefrom, and it seems desirable to distinguish the Canadian from the Californian specimens by a local and at least varietal, if not specific name.

Bela cretacea. (N. Sp.)

Plate 44, fig. 6.

Shell small, angularly subfusiform, and about twice as long as wide, spire shorter than the outer volution; whorls five, the third and fourth obliquely compressed above, laterally compressed below, and subangular at about their mid-height; the outer one moderately convex, obliquely compressed next to the suture, subangular and most prominent considerably above its mid-height, thence tapering abruptly and rapidly into the narrow, nearly straight and channeled base.

Surface marked with flexuous nodose ribs and raised lines of growth, that cross the volutions transversely and run parallel with the outer lip, also by numerous, close-set, minute and rounded spiral ridges. The ribs are most prominent and distinctly nodose on the spiral angulation or shoulder of the later volutions, and the nodes, when examined with a lens, are seen to be obtusely conical and laterally compressed.

Hornby Island, W. Harvey, 1895: two specimens, both of which are now in the Museum of the Survey. The figured specimen, which is the more perfect of the two, is about ten millimetres in length.

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Rostellites Gabbi, White. (Sp.)

Volutilithes Navarroensis, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 102, pl. 19, fig. 86; but, according to Dr. C. A. White, not *V. Navarroensis*, Shumard, 1861.

Rostellites Navarroensis, Conrad. 1865. Amer. Journ. Conch., vol. I, p. 363.

Fulguraria Navarroensis, Whiteaves. 1879. This volume, pt. 2, p. 117, pl. 15, figs. 3 and 3 *a*.

Fulguraria Gabbi, White. 1889. Bull. U. S. Geol. Surv., No. 51, p. 23, pl. III, fig. 1.

Rostellites Gabbi (White) Dall. 1890. Trans. Wagner Free Instit. Sc. Philad., vol. III, p. 71.

Sucia Islands, Dr. Newcombe, 1894, one specimen; Brennan Creek, V.I., Rev. G. W. Taylor, three specimens; and New Vancouver Coal Co's. Mine, Nanaimo, V.I., W. Harvey, 1901, one specimen.

Fusus Kingii, Gabb.

Fusus Kingii, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 85, pl. 28, fig. 204.
" " Whiteaves. 1879. This volume, pt. 2, p. 119, pl. 15, fig. 4.
" " White. 1889. Bull. U.S. Geol. Surv., No. 51, p. 46.

Sucia Islands, Dr. Newcombe, 1894 or 1896: one specimen.

Perissolax brevirostris, Gabb.

Plate 43, fig. 3.

Perissolax brevirostris, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 91, pl. 18, fig. 43.
" " Whiteaves. 1879. This volume, pt. 2, p. 121.
" " White. 1889. Bull. U.S. Geol. Surv., No. 51, p. 46.

Hornby Island, W. Harvey, 1895: a young specimen. Sucia Islands, Dr. Newcombe, 1894 or 1896: the nearly adult and well preserved specimen figured, in which, however, no part of the outer lip is shewn,—and two smaller ones. Quarry on Protection Island, W. Harvey, 1901: three imperfect but fairly characteristic specimens. Brennan Creek, V. I., Rev. G. W. Taylor, 1901: three specimens.

In the first volume of the American Journal of Conchology, published in 1865, and on page 363, Conrad says that the genus *Perissolax* is "peculiar to the Eocene formation" and that *P. brevirostris* is "not a member of the genus, to which it is somewhat doubtfully referred by Mr. Gabb." Dr. Paul Fischer, in his Manuel de Conchyliologie, makes *Perissolax* a subgenus of *Tudicla*.

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Hindsia nodulosa, Whiteaves.

Plate 43, fig. 2.

Fasciolaria nodulosa, Whiteaves. 1874. Geol. Surv. Canada, Rep. Progr. for 1873-74, p. 268, pl. of fossils, figs. 7 and 7*a*, but not 7*b*.

Hindsia nodulosa, Whiteaves. 1879. This volume, pt. 2, p. 125, pl. 15, figs. 6 and 7.

Sucia Islands, Dr. Newcombe, 1896: the specimen figured, which shews the characters of the aperture unusually well. The inner lip shews a thick and comparatively broad deposit of callus or enamel, and two small transverse plicæ. The inner surface of the thickened outer lip has two comparatively large, median denticles, and a small posterior denticle.

Brennan Creek, V. I., Rev. G. W. Taylor, 1901: two specimens that are apparently referable to this species.

Sycodes glaber, Shumard. (Sp.)

Pyrula glabra, Shumard. 1858 (?) Trans. Ac. St. Louis for 1857, vol. I, p. 125.

Ficus cypræoides, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 115, pl. 19, fig. 58.

Sycodes cypræoides, Gabb. 1869. Idem, vol. II, pp. 160 and 221.

Sycodes glaber, Whiteaves. 1879. This volume, pt. 2, p. 125.

Sucia Islands, Dr. Newcombe, 1894 or 1896: two specimens. It is, however, just possible that the specimens from Vancouver and the Sucia Islands that have been referred to this species, may prove to be immature examples of the next.

Cypræa Suciensis, Whiteaves.

Cypræa Suciensis, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 127, pl. III, fig. 5.

Original description.—"Shell small, moderately inflated, narrowly subovate and a little more than half as broad as long, emarginate at both ends, but much more deeply so posteriorly than anteriorly. Spire entirely covered when the outer coating of enamel is perfect, but in the only specimen collected the enamel is partially exfoliated in such a way as to show that underneath it the spire is very small, conical, and composed of at least four volutions, also that it extends just as far backward as the produced posterior end of the outer lip. This partial exfoliation of the outer layer of enamel is, however, barely perceptible to the naked eye, and is not shown in the figure. Outer volution very large in proportion to the rest, broadest and most inflated a little behind the mid-length, abruptly attenuate behind, but narrowing much more gradually in front, its anterior margin being narrowly rounded; outer lip thickened exte-

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riorly and considerably produced behind; inner or columellar lip also produced behind and separated from the outer lip by a narrow channel or canal; characters of the interior of the aperture unknown, though it clearly extended the whole length, and is narrow and linear behind.

"Surface smooth.

"Dimensions of the specimen described (which has been kindly presented by its discoverer to the Museum of the Geological Survey): length, twenty millimetres; greatest breath, twelve millimetres.

"Sucia Islands, Dr. C. F. Newcombe, 1894.

"Most of the aperture of this interesting little fossil is filled with the tough and tenacious matrix, so that it is impossible to ascertain whether there are or are not any crenulations on the inner surface of the outer lip, or any denticulations or plications on the columellar side. The external characters of the specimen, however, would seen to show that it is a small smooth *Cyprœa*, very closely allied to the *C. Cunlifei* of Forbes, * from the Arrialoor group of the Trinchinopoly district of Southern India, and it may prove to be only a variety of that species. The *Cyprœa Bayerquei* and *C. Mathewsoni*, described in the first and second volumes of the Palæontology of California, as from the Tejon group of that state, are now generally regarded as Eocene fossils."

Tessarolax distorta, Gabb.

Tessarolax distorta, Gabb. 1864. Geol. Surv. Calif., Pala-ont., vol. I, p. 126, pl. 20, figs.
" " " 82 and 82, *a-b*.
" " Whiteaves. 1879. This volume, pt. 2, p. 123.
" " Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. 1, sect. IV, p. 127.

Several much finer specimens of this singular species than the one obtained by Mr. Richardson in 1871, were collected at Hornby Island by Mr. Harvey, in 1894, 1895 and 1897, and most of these are now in the Museum of the Survey.

Anchura callosa. (N. Sp.)

Anchura stenoptera, Whiteaves. 1879. This volume, pt. 2, p. 123, pl. 15, figs. 11 and 11 *a*; but probably not *Rostellaria stenoptera*, Goldfuss (1844.)

Shell fusiform, spire elongated, turreted, slender, outer volution expanded and alate, though the exact shape of the alation is not shown in the only specimen that the writer has seen. Volutions eight or nine,

*Transactions of the Geological Society of London, vol. VII (1846), p. 134, pl. 12, fig. 22; and Stoliczka (1868) Cretaceous Cephalopoda of S. India, vol. II, p. 55, pl. 4, fig. 4.

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those of the spire rounded, but slightly compressed laterally, the outer one somewhat inflated, but obliquely flattened next to the suture, subangular and lightly shouldered a little behind its midheight or midlength, and narrowing rapidly to the base anteriorly; outer lip expanded and alate, its posterior margin, the only part of the wing that is clearly shewn, being broadly and shallowly concave; columella incrusted by a large callus, which forms quite a thick rounded projection anteriorly.

Surface marked by rather distant, obtuse and not very prominent plications or rib-like folds, which cross all the volutions transversely and are themselves crossed by numerous small acute, spiral ridges, the shoulder of the outer volution being distinctly nodose.

The foregoing is a description of the imperfect specimen from the Trent River, figured, of the natural size, on Plate 15 of the second part of this volume. This specimen was referred by the writer to the *Rostellaria stenoptera* of Goldfuss, but this reference seems to be no longer tenable. In the Canadian specimen the whorls can scarcely be described as minutely and spirally striated, the ribs on the last volution are not all strongly granulated, and it is by no means certain that its wing, when entire, was narrow and sword shaped. Moreover it does not seem probable that a fossil from the Nanaimo group of the Vancouver Cretaceous is identical with a species from the Upper Greensand of Westphalia. For these reasons it is now thought desirable to distinguish the specimen from the Nanaimo River by a new specific name.

Among the fossils of the California Cretaceous, *Anchura transversa* of Gabb * would seem to come nearest to *A. callosa*, but the former is represented as being wider than long, and of comparatively diminutive size *i. e.*, only ten millimetres in length, by thirteen mm. in width.

Mesostoma Suciense. (N. Sp.)

Plate 44, fig. 7.

Cerithium Lallierianum, var. *Suciense*, Whiteaves. 1879. This volume, pt. 2, p. 122, pl. 15, figs. 10 and 10 *a*; but apparently not a true *Cerithium*, nor a var. of the *C. Lallierianum* of d'Orbigny and other European authors.

Shell imperforate, elongated and about twice as long as wide; volutions six in the most perfect specimen collected and probably seven when perfect, those of the spire rounded and ventricose; suture well defined; outer volution strongly convex at or about its midheight, narrowing abruptly into the rounded base below; aperture broadly and

*Geological Survey of California, Palæontology, volume II, p. 165, pl. 27, fig. 45.

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obliquely suboval or subovate, longer or higher than wide, and narrowest behind, entire, not channelled anteriorly as in *Cerithium*; outer lip simple, inner lip thickened and somewhat reflected or expanded at the base.

Surface marked by narrow, but prominent and rather distant, varix-like ribs, that cross the volutions transversely, and that are themselves crossed by smaller and closer spiral ridges, the points of intersection being minutely tuberculate.

Protection Island, J. Richardson, 1873: "a single and not very perfect individual". Sucia Islands, J. Richardson, 1874: "six well preserved examples." The largest of these specimens is a little more than sixteen millimetres in length. Similar specimens were collected at the Sucia Islands by Dr. Newcombe in 1894 and 1896, and at the Nanaimo River, by Mr. Harvey, in August, 1901. In the figure on Plate 15 of the second part of this volume the number of volutions is represented as eight, but the apical ones are slightly restored. The characters of the aperture are well shewn in the specimen represented by figure 7 on Plate 44.

The reference of the specimens collected by Mr. Richardson to the genus *Mesostoma* (Deshayes, 1861) was first suggested by Dr. Stanton, in 1893, in his memoir on "The Colorado formation and its Invertebrate Fauna," published as Bulletin No. 106 of the U. S. Geological Survey.

Mesostoma (?) intermedium. (N. Sp.)

Plate 43, fig. 4.

Shell imperforate, elongate, slender; volutions nine, those of the spire obliquely flattened and very slightly convex; the last volution moderately inflated at about its midheight and narrowly rounded below; aperture higher than wide, subovate and abruptly pointed posteriorly; outer and inner parts of the lip unknown.

Surface marked by numerous, narrow, rib-like folds, that cross the volutions transversely, and by smaller and still more numerous spiral ridges.

Sucia Islands, Dr. C. F. Newcombe, 1894: four fairly good specimens and one fragment. One of these is twenty-nine millimetres long and has seven volutions preserved. Another was probably about forty millimetres in length, when entire. Brennan Creek, V.I., Rev. G. W. Taylor, 1901: one good specimen and two fragments. The former is only seventeen millimetres long, but has eight volutions well preserved, and there was probably one more at the apex.

This species seems to differ from *M. Suciense* in its uniformly larger size, less ventricose volutions, and perhaps also in its somewhat finer and

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less prominent rib-like folds. As its mouth characters are almost entirely unknown, it is by no means certain that it belongs to the genus *Mesostoma*.

Mesostoma (?) Newcombii. (N. Sp.)

Plate 43, fig. 5.

Shell elongated, slender, more than twice as long as wide; volutions nine or ten, slightly and rather obliquely compressed above or posteriorly, most prominent and rounded below their midheight anteriorly; outer volution short, apparently rounded at its base; characters of the aperture unknown, though the outline of a transverse section of the interior of the last volution near the aperture is obliquely oval.

Surface marked with rather large, low, distant, rounded rib-like folds, that cross the lower part of each volution transversely and are obsolete above, also by numerous, very small and close set spiral ridges.

Approximate dimensions of the only specimen known to the writer, which is slightly imperfect at both ends: length, sixty-six millimetres; greatest breadth, twenty-five mm.

Sucia Islands, Dr. C. F. Newcombe, 1896: one specimen.

Apparently a much larger species than the preceding, with volutions of a different shape, and with different surface markings. It is, however, quite doubtful to what genus this shell should be referred, and it is only provisionally regarded as a *Mesostoma*.

Cerithium Vancouverense. (N. Sp.)

Plate 43, fig. 6.

Shell small, elongated, slender, apex apparently acute, volutions probably about eight or nine, though only six are actually preserved in the best specimen that the writer has seen, and compressed laterally; spire rather more than twice as long as the outer volution, which is also compressed at the sides, and narrowly rounded at the base or anteriorly; characters of the aperture unknown.

Surface marked by strongly defined, straight ribs, that cross the volutions of the spire and upper half of the outer volution transversely, and by spiral rows of small, spirally elongated tubercles. As viewed dorsally, there are four rows of these tubercles on the later volutions of the spire, and on the outer volution there are three or four rows of tubercles above the midheight, and six or seven small spiral ridges without tubercles below.

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Extension mine, near Nanaimo, V. I., W. Harvey, 1901: the specimen figured, which is twelve millimetres long and imperfect at both ends, and a fragment of another. These specimens seem to differ from *C. Skidegatense* in their larger size, more slender spire, and spirally elongated tubercles, but they may represent only a large stratigraphical and geographical variety of that species. In the original description of *C. Skidegatense*, in the third part of this volume, no mention is made of any ribs. Yet of the five specimens from Maud Island upon which the species is based, two shew that all the volutions of the spire are crossed by transverse and straight ribs, that become obsolete and disappear on the lower half of the outer volution.

Cerithium Harveyi. (N. Sp.)

Plate 43, fig. 7.

Shell elongated, more than twice as long as wide; volutions about seven, those of the spire obliquely compressed laterally, and pentagonal in transverse section; outer volution moderately convex, widest at or a little above its midheight, as viewed dorsally, and abruptly narrowing into the channeled base anteriorly; characters of the aperture unknown.

Surface marked by distant variciform ribs, that cross the volutions transversely, with broad nearly flat or shallowly concave spaces between them, and by small beaded or minutely tuberculated spiral ridges. On the last volution but one there are four of these beaded spiral ridges, and on the last there are six spiral ridges and five variciform ribs. These latter are nearly or quite opposite on three or four of the volutions, and are continuous longitudinally for the greater part of the length of the specimen.

Roof of coal, New Vancouver Coal Co.'s mine, Nanaimo, W. Harvey, 1901: two specimens, one, which is somewhat crushed, not very well preserved and slightly imperfect at both ends, being twenty-four millimetres in length by ten millimetres in breadth; while the other, which is figured, is more perfect and better preserved, being about thirteen millimetres long.

The writer has much pleasure in associating with this species the name of its discoverer, Mr. Harvey, whose long continued exertions have added so many novel forms to the fauna of the Vancouver Cretaceous.

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Potamides tenuis, Gabb.

Potamides tenuis, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 130, pl. 20, fig. 86.
" " Whiteaves. 1879. This volume, pt. 2, p. 121, pl. 15, figs. 8 *a*, 8 *a*, *b*.

The references to this species on page 121 of the second part of this volume are somewhat unfortunate. For, in the first place, the two specimens from the "Middle Shales," one of which is figured, are from the north-west side of Hornby, not of Denman Island. And in the next place, the two (not three) very small and imperfect specimens from the "Lower Shales" of Denman and the Sucia Islands, prove to be quite distinct from *P. tenuis*. In Canada, so far as the writer is aware, the typical form of the species, as distinct from the var. *Nanaimoensis*, has been collected only at Hornby Island, by Mr. Richardson, in 1872; at the Sucia Islands, by Dr. Newcombe, in 1894; and from the roof of the coal, Nanaimo mines, V. I., by Mr. Harvey, in 1901.

In specimens of *P. tenuis* from the Chico group of Pences Ranch, California, the typical locality, kindly lent to the writer for comparison by Dr. Stanton, there are eight volutions. The later ones of the spire are each marked with a spiral row of distant obtusely conical nodes, on the angle near the base, but upon the outer volution these nodes are almost or completely absent. The nodes, also, are much smaller in some specimens than they are in others. In those with very small nodes, the whole of the spire and the upper half of the last volution is ribbed longitudinally, that is, in a direction parallel to the main axis, but transversely to each volution. The nodes on the basal angle of the spire of the specimen from Hornby Island, figured on Plate 15 (figure 8) of the second part of this volume, are unusually large, and they are fully developed on the outer volution.

Nerinea dispar ? Gabb. Var.

Nerinea dispar ? Gabb. Var. Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 127, pl. 3, fig. 4.

"Shell essentially similar in shape and surface markings to *N. dispar*, but smaller and devoid of the rounded spiral fold at the base of each volution said to be characteristic of that species, also with the longitudinal ribs apparently obsolete on the lower volutions.

"Hornby Island, W. Harvey, 1894, three specimens. The most perfect of these has seven volutions preserved, with the minute details of the sculpture of each quite clearly shewn. The three upper volutions are marked with small longitudinal ribs that cross the volutions trans-

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versely, but on the three lower volutions these ribs appear to be absent, though their absence may be due to the exfoliation of the outer layer of the shell". (Op. cit. supra.)

Capulus corrugatus. (Nom. prov.)

Plate 45, figs. 2 and 2 *a*.

Shell varying in external contour from conical and considerably elevated, with a subcentral, prominent, pointed and slightly incurved apex, to depressed patelliform, with an obtuse apex; aperture large, irregular in outline, varying from nearly circular to widely subovate, but always a little longer than wide.

Surface marked by narrow, concentric, annular wrinkles, and by fine striæ of growth. Muscular impressions unknown.

Puntledge or Comox River, near Comox, V.I.: three specimens, two collected by Mr. Harvey in 1895, and the other by Mr. Bennett in 1896, all of which are now in the Museum of the Survey.

In the absence of any knowledge of their muscular scars, these specimens are only provisionally referred to the genus *Capulus*, on account of their resemblance, in external form and surface markings, to the *C. cassidarius* and *C. annulatus* of Yokoyama, as described and figured in his memoir on the fossils of the Cretaceous rocks of Japan.* The original of figures 2 and 2*a* on Plate 45 of the present publication, which is the most elevated of the three Comox fossils, is not at all unlike the specimen of *C. cassidarius* figured on Plate xviii, figure 10, of the thirty-sixth volume of the Palæontographica, but in the latter the apex is not so much incurved, and the surface is marked only with five annular striæ of growth. Another of the Comox specimens has much the same kind of surface markings as *C. annulatus*, but in the latter the apex is erect, and the annular wrinkles appear to be proportionately more numerous.

On the other hand, these Comox specimens may prove to be the young of a very large species of *Helcion*, recently discovered at Nanaimo, by Mr. Harvey, which will be found described a little farther on in these pages under the name *H. giganteus*, Schmidt, var. *Vancouverensis*. The apex of a very young specimen of the var. *centralis* of *H. giganteus*, figured by Schmidt on Plate iii, figure 9, of his memoir on the fossils of the Chalk formation of Saghalien (Sachalin)† is very like that of the Comox speci-

*Versteinerungen aus der Japanische Kreide, Palæontographica, Bd. xxxvi, p. 177, pl. 18, figs. 10, *a*, *b*, 11, *a*, *b*; and p. 200, pl. 25, figs. 17, *a*, *b*.

†In the "Mémoires de L'Académie Impériale des Sciences de St.-Pétersbourg," viie Serie, Tome xix, No. 3, pp. 1—37.

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men figured in this publication, but the former shews clearly the commencement of the radiating rib-like folds which characterize the adult shell, and the latter does not.

Vanikoro pulchella. Var.

Cfr. *Vanikoro pulchella*, Whiteaves. 1884. This volume, pt. 3, p. 215, pl. 27, figs. 4 and 4 *a*.

Shell essentially similar to the type and hitherto only known specimen of *V. pulchella*, and apparently differing therefrom only in its somewhat larger size and coarser transverse plications.

Departure Bay, V.I., W. Harvey, 1901 : a large but worn and imperfect specimen, that measures about seventeen millimetres in height by twenty mm. in width.

Texada Island, W. Harvey, 1901 : a well-preserved but fragmentary specimen, consisting of the spire and upper portion of the outer volution. It is in this specimen that the transverse plications are seen to be larger and more prominent proportionately, than those of the type of the species are.

Both of these specimens, when examined with a lens, are seen to be marked with numerous and irregularly disposed, small circular pits, that may indicate the burrows of a *Cliona*.

Lunatia Shumardiana, Gabb.

Lunatia Shumardiana, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 106, pl. 19, fig. 61.

" " White. 1889. Bull. U. S. Geol. Surv., No. 51, p. 45.

"A single example from Sucia Island apparently belongs to this species." (White.) A specimen from the roof of the coal at the Nanaimo mines, collected by Mr. Harvey, in 1901, and now in the Museum of the Survey, may also be referable to *L. Shumardiana*, though its aperture is filled with the matrix, which completely covers the columellar lip.

Gyrodes (Conradiana ? Gabb, var.) Canadensis.

Gyrodes excavata, Whiteaves. 1879. This volume, pt. 2, p. 124, pl. 16. figs. 2 and 2 *a*; but probably not *Natica excavata* of Michelin or d'Orbigny.

Gyrodes Conradiana, White. 1889. Bull. U. S. Geol. Surv., No. 51, p. 45.

Shell always much smaller than *Natica excavata* and the typical *G. Conradiana* and differing from the latter also in having the upper edge or margin of the outer volution narrowly truncated and flattened downward

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next to the suture above. The largest of the specimens collected by Mr. Richardson is about fourteen millimetres high, and of late years a few additional and similar specimens have been collected at the Sucia Islands by Dr. Newcombe, and at Brennan Creek, V.I., by the Rev. G. W. Taylor.

Amauropsis Suciensis, Whiteaves.

Amauropsis Suciensis, Whiteaves. 1879. This volume, pt. 2, p. 123, pl. 16, fig. 1.

Sucia Islands, Dr. Newcombe, 1894 or 1896 : four or five specimens. Texada Island, W. Harvey, 1901 : one specimen.

Odostomia (?) inornata. (N. Sp.)

Plate 43, fig. 8.

Shell very small, imperforate, elongate, narrowly conical and rather more than twice as long as wide ; spire acute. Volutions about five, those of the spire obliquely flattened ; the outer one moderately convex, not quite as wide as high and a little shorter than the spire, as viewed dorsally, and narrowly rounded at the base or anterior end ; suture very lightly impressed ; aperture apparently subovate, rounded anteriorly and pointed posteriorly, outer lip simple.

Surface smooth.

Approximate dimensions of the specimen figured : maximum length, rather more than three millimetres and a half ; greatest width, nearly one mm. and a half.

Nanaimo River, V.I., ten to twelve miles up, W. Harvey, 1901 : one specimen with the test well preserved. This specimen is in the Museum of the Survey.

Odostomia (?) cretacea. (N. Sp.)

Plate 43, fig. 9.

Shell very small, imperforate, elongate pupiform, slender, more than twice as long as wide. Volutions five, compressed laterally but slightly convex ; spire much longer than the outer volution, its apex obtuse ; suture lightly impressed ; aperture obliquely subovate, longer than wide, narrowly rounded at the base in front and pointed behind ; outer lip apparently simple.

Surface markings unknown.

Approximate dimensions of the specimen figured : length, two millimetres and a half ; width, three quarters of a millimetre.

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Brennan Creek, V.I., Rev. G. W. Taylor, 1901 : six specimens, which he has kindly presented to the Museum of the Survey. In each of them the shell substance is decomposed and more or less exfoliated.

Lysis Suciensis, Whiteaves.

Plate 45, figs. 3 and 4.

Stomatia Suciensis, Whiteaves. 1879. This volume, pt. 2, p. 128, pl. 16, figs. 4 and 5.

Typical form.—Sucia Islands, C. F. Newcombe, 1894 : two specimens. One of these, the original of figure 3 on Plate 45, is about forty-three millimetres in height, has the outer surface much worn, and shews little more on the outside than a few distant lines of growth The other, which is about fourteen mm. high, is marked by numerous and close-set minute spiral ridges, as well as by lines of growth. On the inside both shew the "concave expansion of the incrusting layer of the inner lip," which forms such a striking character in the genus *Lysis*, and confirm the suggestion made by Dr. White, in 1889, that the specimens described and figured by the writer under the name *Stomatia Suciensis* "belong to Gabb's genus *Lysis*."*

Var. carinifera.—Brennan Creek, V. I. : two specimens, each with two spiral keels on the outer volution. One of these is a somewhat crushed specimen, some eighteen millimetres high and twenty and a-half wide, the original of figure 4 on plate 45. Its two spiral keels are placed near to each other, just below the mid-height, but on the outer lip each keel, or ridge, is produced into a short, conical, slender spine. The other is a very small specimen, about five mm. high, with the two spiral keels also placed near to each other, a little below the mid-height on the dorsal surface of the last volution. Texada Island, W. Harvey, 1901 : three specimens, each with two spiral keels on the last volution.

Eunema cretaceum, Whiteaves.

Eunema cretaceum, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 126, pl. 3, fig. 3.

Original description and remarks.—"Shell small, imperforate, apparently elongate turbinate, with the spire about equal in height to the outer volution, as viewed dorsally, though the few specimens collected so far are so crushed that their exact original shape is uncertain. Volutions five or six, those of the spire step-shaped or shouldered, but flattened somewhat obliquely next to the shoulder above, the outer volution rounded and moderately ventricose below the shoulder ; suture distinct and angular.

*Bulletin of the U. S. Geological Survey, No. 51, p. 17.

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"Surface marked with narrow but comparatively distant spiral ridges, which are crossed by very numerous, close-set and regularly arranged, acute, longitudinal, thread-like raised lines. On the dorsal portion of the last volution of the spire there are three of these spiral ridges, and upon that of the outer volution about seven. Test thin, its inner layer distinctly nacreous.

"The exact dimensions cannot be given, but an average specimen is estimated to have been eleven millimetres and a-half in length, and nine in maximum breadth, when perfect.

"North-west side of Hornby Island, W. Harvey, 1894: four or five crushed specimens.

"This interesting little shell is referred to the genus *Euomma*, mainly on the authority of Zittel,* who states that *Amberleya*, Morris and Lycett, and *Eucyclus*, Deslongchamps, are synonymous with it, and that it ranges in time from the 'Lower Silurian' into the Cretaceous."

Three additional examples of this species were obtained at Hornby Island, by Mr. Harvey, in 1895, but these throw no additional light on its characters.

Margarita ornatissima, Gabb. (Sp.)

Angaria ornatissima, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 121, pl. 20 fig. 78.

Margarita ornatissima, Whiteaves. 1879. This volume, pt. 2, p. 128.

" " White. 1889. Bull. U. S. Geol. Surv., No. 51, p. 45.

A few additional specimens of this shell were collected at the Sucia Islands, by Dr. Newcombe, in 1894 or 1896; and at Yorke's Farm, two miles and a quarter to two miles and a half up the Nanaimo River, by Mr. Harvey in 1901.

Solariella (radiatula? var.) occidentalis.

Plate 45, figs. 5, and 5 *a*.

Solariella radiatula (Forbes) Schmidt. 1873. Uber die Petref. der Kreide-form. von Sachalin, in Mem. l'Acad. Imper. des Sciences de St. Pétersbourg, Series VII, vol. XIX, p. 18, pl. 4, figs, 3, 4 and 5.

Shell essentially similar to *S. radiatula*, as described and figured by Dr. Schmidt in the memoir cited, but with the upper part of the later volutions, especially that of the outer one, much more distinctly flattened downward next to the suture; or, in other words, more step-shaped above.

*Handbuch der Palæontologie, vol. II, 1884, p. 189.

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The Vancouver specimens may be thus described. Shell small, turbinate, about as high as broad, with a moderately elevated spire and a rather narrow but deep umbilicus. Volutions about six, those of the spire convex, the later ones slightly flattened downward next to the suture, above; the outer one ventricose, but distinctly flattened or even shallowly concave above, rather higher than the spire, as viewed dorsally, umbilicus occupying about one third of the diameter of the base, with a minutely angulated and crenulated margin; aperture apparently nearly circular, lip thin and simple.

Surface marked by numerous, close-set, flattened and obliquely transverse costæ, that are crossed by equally or still more minute, and close-set spiral ridges.

An average specimen is six millimetres broad, and about as high as broad.

A few specimens of this shell were collected quite recently (in 1901) by the Rev. G. W. Taylor, at Brennan Creek, V.I., and by Mr. Harvey, on the Nanaimo River. These agree much better with Schmidt's than with Stoliczka's figures of *S. radiatula*. In the latter the volutions are represented as regularly rounded, and not at all flattened next to the suture. Stoliczka, also, says that *S. radiatula* is "composed of about seven or eight convex volutions," but in the Vancouver Island specimens there are apparently not more than six.

The specimen figured, though the most perfect one that has yet been obtained, is abnormally depressed. All the other specimens are more elevated, and show the flattening at the suture more distinctly.

Phaneta (?) decorata. (N. Sp.)

Plate 45, figs. 6, 6*a*, and 7.

Shell rather small, spiral, wider than high, gently convex and somewhat dome-shaped above, angular and carinate at the periphery, and somewhat flattened at the base below. Volutions two and a half or three, rapidly expanding and strongly embracing; spire short, low, obtuse, partially overlapped by the upper part of the outer volution, and not raised above its highest level; suture indistinct. Outer volution encircled by a narrow, entire and simple spiral keel or keel-like fold; aperture very large, occupying the greater part of the base, nearly circular, but with the continuity of the peristome apparently slightly interrupted by the encroachment of the preceding volution, though this feature is not well seen in either of the few specimens collected; outer lip simple.

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On and above the peripheral keel of the outer volution the whole surface is finely cancellated by minutely tuberculated ridges, which are so arranged as to form regular, equidistant and parallel, obliquely transverse rows, as well as distinct spiral ones. Near the aperture, there are seventeen of these spiral rows of tubercles. Below the peripheral keel there is one spiral ridge and numerous, rather coarse, obliquely transverse growth lines but there are, apparently, no tubercles upon the base. In the largest specimen collected (figure 7) the outer volution, next to the suture above, is partially encircled with a narrow, erect, spiral fold or plication, crossed by oblique non-tuberculated ridges and striæ, as well as by the peripheral alation.

Roof of coal, Nanaimo mines, W. Harvey, 1901: three specimens, which are only provisionally and rather doubtfully referred to H. Adams' genus *Phaneta*. In many respects they agree very well with the generic and specific description, and with the figures, of *P. Everetti*, H. Adams, in the twelfth volume of Tryon's Manual of Conchology, but in *Phaneta* the suture is said to be distinct, the aperture is represented as channeled at the peripheral keel, and the upper surface is not minutely tuberculated. Moreover *P. Everetti*, the type and hitherto only known species of the genus, is known to be a fresh water shell, whereas the Nanaimo specimens are presumably marine, as they are found associated with such purely marine genera as *Crassatella*, *Pectunculus*, *Nucula* proper, *Acila*, *Leda*, *Cinulia*, *Trochactæon*, &c. The sculpture of their upper surface is very like that of some species of *Calliostoma* and *Turcicula*, but their lower surface, including the mouth, is more like that of such a typical *Stomatella* as *S. imbricata*. They may indicate a new generic type of Trochidæ or Stomatellidæ, for which the name *Euphaneta* might be appropriate.

Helcion giganteus? var. Vancouverensis.

Plate 51, fig. 1.

Cfr. *Helcion giganteus*, Schmidt. 1873. Ueb. die Petref. der Kreide-form. von Sachalin, p. 19, pl. 2, figs. 17, 18; pl. 3, figs. 1-10; and pl. 8, figs. 2-5.

Shell very large, patelliform, depressed conical, apex eccentric, placed very near to the anterior margin, but not quite marginal, aperture a little longer than wide, rounded subovate, or nearly circular but somewhat pointed behind.

Surface marked with concentric lines of growth, and low rounded radiating ribs or plications, that are faint and almost obsolete centrally, but fairly well defined around the outer margin.

The specimen described is about four inches in length, and very little less in breadth.

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Nanaimo River, V.I., below the coal, W. Harvey, 1901 : one fine specimen which, however, has a considerable portion of its surface worn and partially eroded. It seems to differ from the typical *H. giganteus* only in the much more feeble development of its radial ribs.

As already stated, it is quite likely that the three fossils from the Comox River described provisionally on pages 364 and 365 as *Capulus corrugatus*, may prove to be very young specimens of this variety of *Helcion giganteus*.

Helcion tenuicostatus. (N. Sp.)

Plate 45, figs. 8 and 8 *a*.

Shell small, depressed conical, not more than one-half as high as wide, apex apparently erect, obtuse, placed in advance of the midlength, and a little to one side, aperture broadly oval.

Surface widely but rather faintly undulated concentrically, and marked by very numerous, narrow, prominent, acute and slightly flexuous, radiating ribs.

Approximate dimensions of the specimen figured : length sixteen millimetres ; width or breadth, twelve mm. ; maximum height, six mm.

Extension mine, near Nanaimo, V.I., nine specimens ; and Texada Island, two or three specimens ; all collected by Mr. Harvey in 1901.

This finely ribbed little limpet seems to differ from the *Helcion granulatus* of Stanton,* from the Knoxville beds of California, in its proportionately greater height, and in the apparent absence of the " rather closely arranged, impressed concentric lines" said to be characteristic of that species.

Genus and species uncertain.

Plate 45, fig. 9.

Six well preserved but somewhat crushed and very imperfect specimens of the shell of a small gasteropod, that the writer has not been able to refer satisfactorily to any known genus, were collected from the roof of the coal at the Nanaimo mines by Mr. Harvey, in 1901, and are now in the Museum of the Survey. One of these has only a single volution preserved ; four, including the one figured, the outer volution and one or two of the preceding ones; and one, part of four volutions of the spire. Their sculpture consists of very numerous and close-set, fine striæ of growth, and a few irregularly disposed, and more or less minute spiral ridges.

* Bulletin of the U. S. Geological Survey, No. 133, p. 63, pl. xii, fig. 4.

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In their shape and surface markings these specimens are apparently very similar to the subcarinate variety of *Campeloma productum*, White* (which seems to be congeneric with *Goniobasis Nebrascensis*), but they evidently have a much thinner test, and a much more lustrous and highly polished surface. They are also somewhat similar, both in shape and sculpture to the *Tylostoma bulimoides* of Stoliczka,† but in the Nanaimo specimens there are no indications of any inner fold-like varices.

Scaphopoda.

Dentalium Nanaimoense, Meek.

Dentalium Nanaimoensis, Meek. 1857. Trans. Albany Inst., vol. IV, p. 44.

Dentalium Koomooksense, Meek. 1876. Bull. Geol. and Geog. Surv. Terr., vol. II, p. 364, pl. 3, fig. 6.

Dentalium Nanaimoense, Whiteaves. 1879. This volume, pt. 2, pl. 133, pl. 16, figs. 9, 9 *a*, *b*.

The specimens of this species that were described and figured by Meek are from Nanaimo and Comox, as is clearly indicated by the two names cited in the foregoing synonymy. Similar specimens were obtained by Mr. Richardson, two miles and a half up the Nanaimo River, and at Denman Island, in 1872; at the Sucia Islands in 1874, and at Admiralty Island in 1875. Quite recently, in 1901, one specimen of *D. Nanaimoense* was collected at Brennan Creek, V. I., by the Rev. G. W. Taylor; and another two miles and a quarter to two miles and a half up the Nanaimo River, by Mr. Harvey.

Entalis Cooperi, Gabb.

Dentalium Cooperi, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 139, pl. 21, fig. 100.

Entalis Cooperi, Whiteaves. 1879. This volume, pt. 2, p. 134, pl. 16, figs. 10 and 10 *a*.

Additional specimens of *E. Cooperi* were collected at Hornby Island by Mr. Harvey in 1894.

Pelecypoda.

Martesia (?) parvula. (N. Sp.)

Plate 45, fig. 10.

Shell very small for the genus, moderately elongated, narrowly subovate and not quite twice as long as high. Anterior side short, abruptly

* As figured on Plate 26, figs. 24, 25 and 26, of his "Non Marine Mollusca of North America," published in 1883, by the U. S. Geological Survey.

† Cretaceous Gasteropoda of Southern India, pp. 42 and 448, pl. v, fig. 5.

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rounded, but faintly subangular at the midheight in marginal outline, the foot opening of moderate size, and closed with a callous plate, or thin calcareous deposit; posterior side somewhat attenuate, longer than the anterior and more narrowly rounded at its termination exteriorly; ventral margin nearly straight at and behind the midlength; superior border sloping abruptly downward in front of the beaks, and much more gradually so behind them; beaks placed in advance of the midlength but not quite terminal: accessory valves, if any, unknown.

Surface marked with an obliquely transverse, narrow umbono-ventral groove that is bounded on each side by a row of minute punctures, and by concentric striations or sulci, that are coarser behind this groove than in front of it.

Interior of the valves unknown.

Dimensions of the specimen figured: length, ten millimetres and a quarter; maximum height, five mm. and three-quarters.

Extension mine, near Nanaimo, V.I., W. Harvey, 1901: the right valve figured, which is now in the Museum of the Survey.

This little shell is not nearly so attenuate behind nor so ventricose anteriorly as the Vancouver Island specimens of *Martesia clausa*, Gabb, that are described and figured in the second part of this volume.* It is by no means certain that the former is a true *Martesia*.

Cymbophora Ashburneri, Gabb.

1. Large ribbed variety.

Mactra Ashburneri, Gabb (pars). 1864. Geol. Surv. Calif., Palæont., vol. I, p. 153.
Cymbophora Ashburneri, Gabb (pars). 1869. Idem, vol. II, p. 181.
" " Whiteaves. 1879. This volume, pt. 2, p. 141, pl. 17, fig. 8.

Shell comparatively large; whole surface concentrically ribbed, the ribs separated by deep grooves, and both ribs and furrows minutely and concentrically striated.

Specimens of this form of *C. Ashburneri* were collected by Mr. James Richardson at Blunden Point, Vancouver Island, in 1871; at Hornby and Protection islands in 1873; and at the Sucia islands in 1874. Similar specimens have since been collected at the Sucia Islands by Dr. C. F. Newcombe, in 1894; at Brennan Creek, V.I., and at Protection Island by the Rev. G. W. Taylor, in 1901; also at Protection and Texada islands by Mr. Harvey, in 1901.

*On page 137, and Plate 17, figs. 2, 2 *a* and 2 *b*.

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2. Small, nearly smooth variety.

Mactra (Cymbophora?) Warrenana, Whiteaves. 1879. This volume, pt. 2, p. 142, pl. 17, fig. 9, and pl. 19, figs. 3 and 3 *a*; but perhaps not *Cymbophora Warrenana* of Meek and Hayden.

Shell comparatively small, concentric ribs nearly or altogether obsolete, the surface markings for the most part consisting of close-set concentric striæ, and from one to three distant groove-like constrictions, or periodic arrests of growth.

Specimens which the writer once thought to be possibly identical with the *Cymbophora Warrenana* of Meek and Hayden, but which can scarcely be satisfactorily distinguished from *C. Ashburneri*, were collected by Mr. Richardson at the Sucia Islands in 1874, and two miles and a half up the Nanaimo River, V.I., in 1875. Similar specimens have since been collected at the Sucia Islands by Dr. Newcombe (in 1894), and at Brennan Creek, V.I., by the Rev. G. W. Taylor (in 1901).

Anatina sulcatina? Shumard.

Anatina sulcatina? Shumard. 1861. Proc. Boston Nat. Hist. Soc., vol. VIII, p. 204.
Anatina sulcatina, Whiteaves. 1879. This volume, pt. 2, p. 139, pl. 17, figs 5 and 5 *a*.
Anatina sulcatina? Shumard. White. 1889. Bull. U. S. Geol. Surv., No. 51, p. 43, pl. VI, fig. 1.

Doctors C. A. White and T. W. Stanton are inclined to think that the Sucia Island specimens that have been referred to *A. sulcatina* are probably distinct therefrom, and it is of course quite possible that this may be the case, as Shumard never figured his species. An additional specimen of an *Anatina* that would seem to be at least very similar to *A. sulcatina*, but that it might be convenient to distinguish provisionally by the name *A. affinis*, was collected at the Sucia Islands by Dr. Newcombe in 1894; and a similar one at Brennan Creek, V. I., by the Rev. G. W. Taylor in 1901.

Anatina subcylindracea. (N. Sp.)

Plate 45, fig. 11.

Shell rather small, moderately convex, slightly compressed, very inequilateral, straight, elongated, a little more than twice as long as high, and subtruncate at both ends. Anterior side much shorter than the posterior; anterior end truncated almost vertically but somewhat obliquely above and rounded below; posterior end abruptly truncated and widely gaping; cardinal border long, horizontal and nearly straight, behind the beaks; ventral margin also straight for the greater part of its length and

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parallel with the posterior part of the cardinal border; beaks small, incurved and placed in advance of the midlength.

Surface concentrically striated.

Hinge dentition and muscular impressions unknown.

Dimensions of the specimen figured: maximum length, 24·6 mm.; greatest height, 11.

Brennan Creek, V.I., Rev. G. W. Taylor: one specimen and a fragment of another, both of which have been kindly presented to the Museum of the Survey.

Thracia subtruncata, Meek.

Thracia(?) subtruncata, Meek. 1857. Trans. Albany Inst., vol. IV, p. 44.
" " Meek. 1876. Bull. Geol. and Geogr. Surv. Terr., vol. II, no 4, p. 363, pl. 2, figs. 4 and 4 *a*.
" " Whiteaves. 1879. This volume, pt. 2, p. 140, pl. 17, fig. 7.

Two specimens of this shell were collected at the Sucia Islands by Dr. Newcombe in 1894.

Pholadomya subelongata, Meek.

Pholadomya subelongata, Meek. 1857. Trans. Albany Inst., vol. IV, p. 41.
" " Meek. 1876. Bull. Geol. and Geogr. Surv. Terr., vol. II, no. 4, p. 362, pl. 2, figs. 1 and 1 *a*.
Pholadomya Royana, Whiteaves. 1879. This volume, pt. 2, p. 140. But probably not *P. Royana*, d'Orbigny, 1844, which Pictet makes a synonym of *P. nodulifera*, Munster, in Goldfuss.

Additional examples of this species have been collected at the Sucia Islands by Dr. Newcombe in 1894, and from the roof of the coal at the Nanaimo mines by Mr. Harvey in 1901.

Panopæa concentrica, Gabb. Var.

Cfr. *Panopæa concentrica*, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 148, pl. 22, fig. 119.
Homomya concentrica, Gabb. 1869. Idem, vol. II, pp. 179 and 236.

Texada Island, W. Harvey, October, 1901: two imperfect casts of the interior of both valves, with portions of the test preserved. The larger of these is fully four inches in length and the smaller nearly three and a half. These specimens seem to differ from the Californian types of *Panopæa* (or *Homomya*) *concentrica* in their longitudinally elliptic-subovate rather than subquadrate outline, in their broader, more obtuse and more nearly median umbones, and in their

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shallowly concave superior border behind. Their test is comparatively thick and neither minutely granulated nor punctate.

Cuspidaria Suciensis. (N. Sp.)

Plate 46, fig. 2.

Shell rather small, moderately convex, somewhat compressed, nearly twice as long as high and very inequilateral. Anterior side rounded, longer and much broader than the posterior side, which is abruptly and somewhat concavely contracted both above and below; ventral margin strongly convex, most prominent at the midlength; superior border, straight and horizontal behind the beak, which is incurved, slightly recurved, and placed behind the midlength; posterior umbonal slope faintly angulated.

Surface concentrically striated; test very thin.

Hinge dentition and muscular impressions unknown.

Sucia Island, Dr. C. F. Newcombe, 1894: the specimen figured, which is a perfect cast of the interior of a right valve, with small portions of the test preserved.

Dimensions of the specimen: maximum length, not quite fourteen millimetres; greatest height, nine mm. and a half.

This little shell is provisionally referred to the genus *Cuspidaria*, on account of its cuspidate posterior extremity and extremely thin test.

Tellina occidentalis, Whiteaves.

Tellina (Peronæa) occidentalis, Whiteaves. 1879. This volume, pt. 2, p. 144, pl. 17, figs. 11 and 11 *a*; but not *Tellina occidentalis*, Morton, 1842, which is a *Lucina*; nor *Thracia (?) occidentalis*, Meek, 1857.

Tellina occidentalis, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 126.

"The specimens from Gabriola Island and the Nanaimo River, which the writer formerly supposed to be referable to *Thracia occidentalis*, Meek, prove to be distinct from that shell, which Mr. Stanton states has a pearly lustre and other characters of the Anatinidæ." (Op. cit., 1896.)

Tellina Nanaimoensis. (N. Sp.)

Plate 46, fig. 3.

Tellina (Peronæoderma) Mathewsoni, Whiteaves. 1879. This volume, pt. 2, p. 143; but probably not *Tellina Mathewsoni*, Gabb.

Shell strongly compressed, thin, the thickness through the closed valves being not much more than a third of their height, broadly sub-

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elliptical, about one fourth longer than high and almost equilateral. Anterior and posterior sides about equal in length, their extremities narrowly rounded; ventral margin very slightly convex, almost straight in the middle; superior border sloping rather rapidly downward on both sides of the beaks, which are small, median, incurved and slightly recurved.

Surface marked with very numerous and closely arranged, minute and concentric raised lines of growth.

Hinge dentition and anterior muscular impression unknown; posterior muscular impression narrowly elongate, lanceolate subovate, widest below and acutely pointed above.

The specimen figured is not sufficiently perfect to admit of very accurate measurements being given, but the figure is of the natural size.

Nanaimo River, V.I., J. Richardson, 1875: an imperfect but well preserved cast of the interior of both valves, with part of the test preserved upon each.

Judging by the figure on Plate 23 of the first volume of the Palæontology of California, the true *T. Mathewsoni* is more elongate, more pointed at both ends, and consequently more nearly triangular in outline.

Asaphis multicostata, Gabb.

Asaphis multicostata, Gabb. 1869. Geol. Surv. Calif., Palæont., vol. I, pp. 181 and 236, pl. 29, fig. 70.

Linearia Suciensis, Whiteaves. 1879. This volume, pt. 2, p. 146, pl. 17, fig. 12.

Sucia Islands, J. Richardson, 1875: the type of *L. Suciensis*. Nanaimo mines, V. I., W. Harvey, 1901: a small left valve.

In a report upon the Cretaceous fossils from Spanish Gulch, Oregon, published in 1901, in Professor J. C. Merriam's "Contribution to the Geology of the John Day Basin," Dr. Stanton writes that *L. Suciensis* is "similar in form and sculpture" to *Asaphis multicostata*, "and may be based upon the same species." And, still more recently, a direct comparison of *L. Suciensis* with two authentic Oregon specimens of *A. multicostata*, kindly forwarded by Dr. Stanton, has induced the writer to come to the same conclusion.

Meretrix nitida, Gabb.

Cytherea Leonensis, Etheridge. 1861. In Hector's paper in the Quart. Journ. Geol. Soc. Lond., vol. XVII, p. 432; but not *C. Leonensis*, Conrad, 1859.

Cytherea Conensis (err. typ. for *Leonensis*) Etheridge. 1863. No. 42 of the list of specimens on p. 243 of Capt. Palliser's Official Report.

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Venus (Mercenaria?) varians, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 161, pl. 23, figs. 140, 140 *a*, and 141.

Meretrix nitida, Gabb. 1864. Idem, p. 165, pl. 23, fig. 147.

Caryatis nitida, Gabb. 1869. Ibid., vol. II, pp. 186 and 240.

Chione varians, Gabb. 1869. Ibid., p. 239.

Cytherea (Caryatis) plana, Whiteaves. 1879. This volume, pt. 2, p. 149, pl. 17, figs. 14, 14 *a*, and 14 *b*; but probably not "*Venus planus*," Sowerby, nor *Aphrodina Tippana*, Conrad.

Cytherea nitida, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, pp. 114 and 124.

Meretrix varians, Stanton. 1901. Univ. Calif., Bull. Dept. Geol., vol. II, pp. 281 and 283.

Departure Bay, Nanaimo (below the lignite) Dr. Hector, 1860, collected by Mr. Mackay: ten rough casts of the interior of single valves of this species, each labelled No. 42, *Cytherea Leonensis*.

Entrance to Departure Bay, V. I., one imperfect valve; and Nanaimo River, V. I., two miles and a quarter up, two specimens; J. Richardson, 1872. Sucia Islands, J. Richardson, 1875: several specimens.

Texada Island, W. Harvey, 1901: several fine specimens.

The latest name that Dr. Stanton gives to this species is *Meretrix varians*, but it would appear to be preoccupied. The names *Meretrix* and *Cytherea* were given by Lamarck at different times to the same genus, and Hanley, in 1844, described a recent marine shell, under the name *Cytherea varians*, in the proceedings of the Linnæan Society, and figured it on Plate 15, figure 33, of his Illustrated and Descriptive Catalogue of Recent Bivalve Shells, an appendix to Wood's Index Testaceologicus. For these references the writer is indebted to Dr. Dall, who writes that "the name *Cytherea* must give way to *Meretrix*, if for no other reason than because *Cytherea* was used by Fabricius for Diptera a year before Lamarck used it for a mollusk. It is true Bolten used it before either of them, but Bolten's *Cytherea* is a totally distinct thing from Lamarck's."

Meretrix arata, Gabb.

Meretrix arata, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 166, pl. 30, fig. 250; and (1869) vol. II, p. 240.

Cytherea (Callista) laciniata, Whiteaves. 1879. This volume, pt. 2, p. 148, pl. 17, figs. 13 and 13 *a*, and plate 19, figs. 4 and 4 *a*; but probably not *Cytherea (Callista) laciniata*, Stoliczka, 1871.

Cytherea arata, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 125.

"The specimens referred to *Cytherea* (*Callista*) *laciniata*, Stoliczka," in the second part of this volume have "been found to be exactly similar to a specimen from the Chico group of Tehama county, California, which

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Dr. Stanton has identified with *Meretrix arata*, Gabb, and kindly loaned to the writer. The original description of the sculpture of *M. arata* is rather misleading. According to Mr. Gabb, its surface is 'ornamented by regular, concentric, acute impressed lines,' whereas, in the writer's judgment, it would be much more correct to say by small, concentric, rounded ribs, with very narrow furrows between them" (1896, op. cit. supra.)

A few additional specimens of this species were collected at the Sucia Islands by Dr. Newcombe in 1894 and 1896. A small but perfect left valve, some sixteen millimetres long, collected at Texada Island, by Mr. Harvey, in 1901, seems to be intermediate in its character between *M. nitida* and *M. arata*. On and immediately around the umbo the surface of this specimen is minutely and regularly ribbed concentrically, but, below, fully two-thirds of the surface are only striated in the same direction.

Cyprimeria lens, Whiteaves.

Cyprimeria lens, Whiteaves. 1879. This volume, pt. 2, p. 152, pl. 17, figs. 15 and 15 *a*; but not *Meretrix lens*, Gabb, 1864, which is probably not a *Cyprimeria*.
" " White. 1889. Bull. U. S. Geological Surv., No. 51, p. 42.
" " Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 125.

"Shell compressed convex, moderately inflated, ovately subcircular in marginal outline, and nearly as high as long; posterior side a little longer, and in some specimens rather more narrowly rounded than the anterior; basal margin broadly convex; superior border descending rapidly and obliquely in front of the beaks, gently convex and slightly prominent immediately behind them, thence curving gradually downward to the posterior end, beaks placed a little in advance of the midlength, small, depressed, appressed and curved forward. No definite nor distinctly margined lunule, and apparently no well defined escutcheon.

"Test rather thick, its surface polished and marked with numerous very fine and closely disposed concentric striæ, also with four or five distant and coarser linear concentric grooves or periodic arrests of growth.

"Hinge with two cardinal teeth and one lateral tooth in the left valve. The two cardinal teeth are transverse and divergent, the anterior one being thick and excavated in the middle, but not bifid. The lateral tooth, which is thin and feebly developed, is partially separated from the cardinal fulcrum by a narrow shallow groove. Anterior muscular impression large and subovate; posterior muscular scar, pallial line and hinge dentition of the right valve unknown.

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"North-west side of Hornby Island, J. Richardson, 1872. one left valve. Sucia Islands, J. Richardson, 1874: three imperfect right valves and one left valve, the latter showing the hinge dentition of that valve; and Dr. C. F. Newcombe, 1894, one large and perfect left valve.

"These are most probably not identical with the *Meretrix lens* of Gabb, as the writer once supposed they were. The specimen from Hornby Island is a little more pointed posteriorly than those from the Sucia Islands, but this feature is rather exaggerated in the unsatisfactory figure of this specimen, on Plate 17" of the second part of this volume. "The specimens from the Sucia Islands have more the general contour of a *Dosinia* than of a *Meretrix* (or *Cytherea*)" . . . . . "and their hinge dentition is that of *Cyprimeria*. In the original description of *Meretrix lens* nothing is said, and nothing appears to be known, about the hinge dentition or other characters of the interior of the shell, but there are at present no valid reasons known to the writer for doubting the correctness of its reference to the genus *Meretrix* or *Cytherea*.

"Mr. Stanton, who has kindly compared the Sucia Island specimens with Meek's types of *Cyprimeria ? tenuis*, from Vancouver and Newcastle islands, thinks that the latter species (whose internal characters are still unknown) is much more compressed and has a different outline" (1896, op. cit. supra).

Additional specimens of *C. lens* were collected by Dr. Newcombe, in 1896, at the Sucia Islands; by Mr. Harvey, in 1901, ten to twelve miles up the Nanaimo River, V.I., and on Texada Island; and by Mr. T. Bryant, in 1901, six or seven miles north-west of Wellington, V.I.

Dosinia inflata, Gabb.

Dosinia inflata, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 168, pl. 23, fig. 149.

Sucia Islands, Dr. C. F. Newcombe, 1896: one remarkably well preserved but slightly imperfect specimen, that corresponds perfectly with Gabb's description of *D. inflata*. In this genus it is almost impossible to identify species by descriptions and figures, but Mr. Frank M. Anderson has kindly compared this Sucia Island specimen with the type of *D. inflata* in the Geological Museum of the University of California, at Berkeley, and thinks that it agrees very well therewith.

Cyprina Denmanensis. (N. Sp.)

Shell large, compressed convex, apparently ovately subtriangular in marginal outline, and about one-sixth longer than high. Superior border

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sloping somewhat concavely and obliquely downward in front of the beaks, and rather convexly as well as obliquely behind them; ventral margin very slightly convex, nearly straight in the middle; umbo and beak nearly median; posterior side not much longer than the anterior.

Surface concentrically and rather coarsely striated.

Hinge dentition and muscular impressions unknown.

FIG. 25.—*Cyprina Denmanensis.* Outline of the only specimen collected, about five sixths of the natural size.

West side of Denman Island, Dr. C. F. Newcombe, 1896: the large right valve figured, which, unfortunately, has the umbo and lateral margins considerably eroded. The specimen, however, seems to indicate a species of *Cyprina* that differs alike from *C. occidentalis* of the Cretaceous rocks of the Queen Charlotte Islands, from *C. Dalli*, White, of the Cretaceous rocks of Alaska, and from the *C. ovata*, var. *alta*, of the Pierre-Fox Hills or Montana formation of Assiniboia and Alberta, in its much larger size, more nearly median beaks, and much straighter ventral margin.

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Cyprina (?) anthracicola. (N. Sp.)

Shell of medium size for the genus, presumably compressed convex normally, though all the specimens that the writer has seen are crushed flat. In this condition they are rounded subovate and very little longer than high. The anterior side is short and rounded; the posterior side a little longer, its extremity subtruncate abruptly and somewhat obliquely above, and obtusely subangular below. The ventral margin is broadly rounded; the superior border slopes abruptly downward in front of the beaks, and much more gradually so behind them; the beaks are compressed, slightly depressed, and placed considerably in advance of the mid-length of the cardinal margin.

Fig. 26.—*Cyprina (?) anthracicola.* Side view of the most perfect but not the largest specimen collected, of the natural size and shewing the right valve. It is crushed quite flat.

Surface marked with very numerous and closely disposed, fine concentric ridges, or raised lines of growth, and a few much coarser and more distant concentric sulcations. Test thick.

Hinge dentition and muscular impressions unknown.

The largest specimen that the writer has seen is sixty-five millimetres long and sixty millimetres high.

Roof of coal, No. 1 shaft, Nanaimo: two nearly perfect, but crushed and flattened specimens, and four very imperfect ones, all collected in 1901, the specimen figured, by the Rev. G. W. Taylor, and the others by Mr. Harvey.

It is just possible that these specimens may prove to be only immature examples of *C. Denmanensis*, but their beaks are by no means submedian and their marginal outline seems to be more rounded than triangular.

Protocardia scitula, Meek.

Cardium scitulum, Meek. 1857. Trans. Albany Inst., vol. iv, p. 40.

Protocardia scitula, Meek. 1876. Bull. Geol. and Geogr. Surv. Terr., vol. ii, no. 4, p. 360, pl. 3, figs. 4 and 4 *a*.

Protocardium scitulum, Whiteaves. 1879. This volume, pt. 2, p. 155.

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Several specimens, that are clearly referable to this diminutive species, were collected at Yorke's farm, two and a quarter to two and a half miles up the Nanaimo River, V.I., by Mr. Harvey in 1901.

Thyasira cretacea, Whiteaves.

Conchocele cretacea, Whiteaves. 1874. Geol. Surv. Canada, Rep. Progr. for 1873-74, p. 266, pl. of fossils, figs. 2 and 2 *a*; and (1879) this volume, pt. 2, p. 156.

On page 784 of his "Synopsis of the Lucinaceæ and of the American species," published in 1901, in volume xxiii of the Proceedings of the U. S. National Museum, Dr. Dall places *Conchocele*, Gabb, 1866; *Cryptodon*, Turton, 1822; and *Axinus*, J. Sowerby, 1821; among the synonyms of *Thyasira*, Leach, 1818. The proper name for this species, therefore, would seem to be *Thyasira cretacea*, and the writer has seen no other specimens of it than those collected below Dodd Narrows. V.I., by Mr. Richardson in 1873.

Clisocolus dubius, Gabb.

Loripes dubius, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. i, p. 177, pl. 24, figs 170 and 171.

Clisocolus dubius, Gabb. 1869. Idem, vol. ii, p. 189, pl. 30, fig. 7.

Lucina Richardsonii, Whiteaves. 1874. Rep. Progr. of this Survey for 1873-74, p. 266, pl. of fossils, fig. 1.

Thetiopsis circularis, Whiteaves. 1879. This volume, pt. 2, p. 153.

Clisocolus dubius, White. 1889. Bull. U. S. Geol. Surv., No. 51, p. 41, pl. 6, figs. 5-7.

" " Whiteaves. 1895. Trans. Royal Soc. Canada, Second Series, vol. i, sect. iv, p. 123.

As stated in the publication last cited, "the specimens from Vancouver, Hornby and the Sucia Islands, which the writer first described as *Lucina Richardsonii*, and afterwards referred to the *Thetis circularis* of Meek and Hayden, the type of Meek's suggested genus *Thetiopsis*, are obviously identical with the *Clisocolus dubius* as since figured by Dr. C. A. White, and with specimens from the Chico group of Shasta county, California, labelled *C. dubius*, and kindly loaned by Mr. Stanton. "It still, however, appears to the writer that the specimens collected by Mr. Richardson are much more like the *Thetis circularis*, as figured by Meek and by Whitfield, than they are to Gabb's illustrations of *C. dubius*."

Specimens of this species were collected at the Sucia Islands by Dr. Newcombe in 1894; and at Departure Bay, V. I., by Mr. Harvey in 1901.

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Clisocolus cordatus, Whiteaves.

Clisocolus cordatus, Whiteaves. 1879. This volume, pt. 2, p. 157, pl. 18, figs. 3, 3, *a-b*; but probably not *Cyprina cordata* of Meek and Hayden (1857) nor *Clisocolus dubius*, Gabb.

" " White. 1889. Bull. U.S. Geol. Surv., No. 51, p. 41, pl. 6, figs. 8 and 9.

" " Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 124.

"The identification of the Sucia Islands specimens collected by Mr. Richardson with the species from the Fox Hills group of Dakota, which was first described by Meek and Hayden as *Cyprina cordata*, and subsequently by Meek as *Sphæriola cordata*, has not proved satisfactory, and they seem to be quite distinct from Gabb's *Clisocolus dubius*" (1896. op. cit. supra.)

A few specimens, which seem to be referable to *C. cordatus*, were collected in 1901 at Brennan Creek, V.I., by the Rev. G. W. Taylor; and at Departure Bay, V.I., by Mr. Harvey.

Crassatella Conradiana, Gabb. (Sp.)

Astarte Conradiana, Gabb. 1864. Geol. Surv., Calif., Palæont., vol. I, p. 178, pl. 24, fig. 161.

" " Whiteaves. 1879. This volume, pt. 2, p. 160, pl. 18, figs. 5 and 5 *a*.

Specimens of this species were collected at the Sucia Islands by Dr. Newcombe in 1894 or 1896, and at Texada Island by Mr. Harvey in 1901.

Crassatella Conradiana, var. tuscana.

Astarte Tuscana, Gabb. 1864. Geol. Surv., Calif., Palæont., vol. I, p. 179, pl. 30, fig. 257.

Astarte cardinioides, Whiteaves. 1874. Rep. Progr. of this Survey for 1873-74, p. 267, pl. of fossils, fig. 3.

Astarte Vancouverensis, Whiteaves. 1874. Idem., p. 267, pl. of fossils, fig. 4.

Astarte Conradiana, var. *Tuscana*, Whiteaves. 1879. This volume, pt. 2, p. 160, pl. 18, fig. 6.

Crassatella Tuscana, White. 1889. Bull. U. S. Geol. Surv., No. 51, p. 39.

Mr. Harvey has collected numerous specimens, which, in the writer's judgment, are referable to this elongated variety of *C. Conradiana*, at North West Bay, Vancouver Island, in 1897; from the roof of the coal at the Nanaimo mines, V.I., and at Texada Island, in 1901.

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Opis Vancouverensis, Whiteaves.

Opis Vancouverensis, Whiteaves. 1879. This volume, pt. 2, p. 158, pl. 18, figs. 4 and 4 *a*.

This species was based upon a slightly imperfect right valve, collected on the south-west side of Denman Island by Mr. Richardson in 1871. The only other specimen of it that the writer has seen is a still more imperfect but characteristic right valve, collected at Brennan Creek, near Wellington, V.I., by the Rev. G. W. Taylor, in 1901.

Unio Nanaimoensis, Whiteaves.

Unio Nanaimoensis, Whiteaves. 1901. Ottawa Naturalist, vol. xiv, pp. 177-79, figs. 1 and 1*a*.

"In the second volume of the Palæontology of California, published in 1869, Mr. W. M. Gabb described and figured a Cretaceous species of *Unio*, which he called *U. Hubbardi*. This species was based upon a single specimen, which is said to be "from the Nanaimo Coal Mine, Vancouver Island," and to have been "kindly loaned" to Mr. Gabb by Mr. Samuel Hubbard. It has long seemed to the writer that the evidence for this locality is very unsatisfactory, and that there are two strong reasons for supposing that some mistake has been made in regard to it. The first of these reasons is that no similar specimens have since been found in the Cretaceous rocks at Nanaimo, or any other locality in Vancouver, or any of the immediately adjacent islands, by members of the staff of the Geological Survey of Canada, or by local collectors. The second is that numerous very typical specimens of *U. Hubbardi* were collected at the Cowgitz coal mine, on Graham Island (one of the Queen Charlotte Islands) by Mr. James Richardson in 1872, and by Dr. G. M. Dawson in 1878.

"No other land or fresh water shells have yet been recorded as occurring in the Cretaceous rocks of the Nanaimo, Comox, or Cowitchan coal fields. But in March, 1894, a nearly perfect but somewhat crushed and slightly distorted bivalve shell was found by Mr. W. Haggart, in shale at the top of No. 6 Pit, Wellington Colliery, Nanaimo. This specimen is now the property of the Provincial Museum, Victoria, B.C., and has been forwarded to the writer by Dr. C. F. Newcombe, of that city, for examination and comparison.

"Judging by its external form and surface markings, this fossil seems to be a specimen of a previously undescribed species of *Unio*, that is quite distinct from *U. Hubbardi* and from any of the Unionidæ of the Cretaceous or Laramie rocks of North America.

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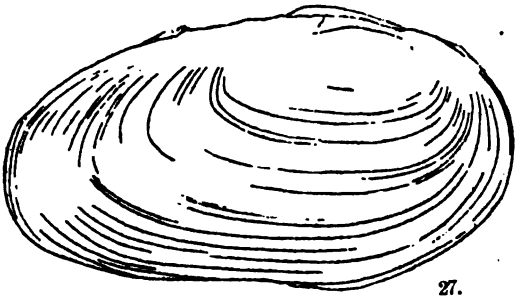
"The species may now be provisionally named and characterized as follows :—

UNIO NANAIMOENSIS (Sp. nov.)"

"Shell compressed-convex, ovately subelliptical, much longer than high, higher than broad, and very inequilateral. Anterior end short, rounded; posterior end much longer than the anterior, its extremity obliquely subtruncate above, produced and somewhat narrowly rounded below; beaks placed in advance of the midlength; posterior umbonal slopes not at all angulated.

27a.



27.

"Surface marked only with numerous concentric lines of growth. Hinge dentition, muscular impressions, and pallial line unknown.

FIG. 27.—*Unio Nanaimoensis.*—Side view of the only specimen known, in outline.

FIG. 27*a*.—Dorsal view of the same, also in outline, to shew the proportionate convexity of the closed valves.

Both the figures are of the natural size.

"Approximate dimensions of the specimen figured:—Maximum length, sixty-eight millimetres; greatest height, thirty-seven millimetres; maximum breadth or thickness, twenty-four millimetres.

"The slight distortion and somewhat slickensided movement to which the specimen has been subjected has so displaced the normal position of the valves that the marginal outline is not as distinctly defined as might be desired, and the beaks are no longer quite opposite.

"As compared with *U. Nanaimoensis*, *U. Hubbardi* is a much more convex shell, with distinctly angular or subangular posterior umbonal slopes, and it is much more attenuate posteriorly" (op. cit. supra.).

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Trigonia Evansana, Meek.

Trigonia Evansana, Meek. 1857. Trans. Albany Inst., vol. IV, p. 42.

Trigonia Emoryi, Etheridge. 1861. In Hector's paper "On the Geology of the Country between Lake Superior and the Pacific Ocean," Quart. Journ. Geol. Soc. Lond., vol. xvii, p. 432; but not *T. Emoryi*, Conrad, 1857.

" " Etheridge. 1863. No. 40 of the list of specimens on p. 243 of Capt. Palliser's Official Report on his Explorations in British America in 1857–60.

Trigonia Evansii, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 189, pl. 25, fig. 17.

Trigonia Evansi, Meek. 1876. Bull. U. S. Geol. and Geogr. Surv. Terr, vol. II, No. 4, p. 359, pl. 2, figs. 7, 7*a* and 7*b*.

Trigonia Evansana, Whiteaves. 1879. This volume, pt. 2, p. 161; and (1896) Trans. Royal Soc. Canada for 1895, Second Series, sect. IV, p. 114.

In 1876, in the second volume of the Bulletin of the United States Geological and Geographical Survey of the Territories, Mr. Meek pointed out that his *Trigonia Evansana* is "almost certainly the same shell that was referred by Mr. Etheridge, among Mr. Hector's collections from Nanaimo, to *T. Emoryi* Conrad (pl. III, figs. 2 *a*, *b*, *c*, United States and Mexico Boundary Survey Report.)" "It is, however," he says, "certainly very distinct from that species, not only in form and in its decidedly less crenate costæ, but more particularly in having a smooth, longitudinally sulcate, depressed ridge on each side of its escutcheon, not crossed by the costæ. Its costæ are likewise less numerous and more prominent."

In 1894, the Geological Society of London, through its president, Dr. Henry Woodward, kindly lent to the writer for study, all the Cretaceous fossils obtained during Captain Palliser's explorations, that were deposited at Burlington House. These form the subject of a paper published in 1896, in the first volume of the second series of the Transactions of the Royal Society of Canada. Among them were "ten specimens, mostly mere casts of the interior of single valves, each labelled 'No. 40, *Trigonia Emoryi*, Conrad; below the lignite, Departure Bay, Nanaimo, Dr. Hector, 1860; collected by Mr. Mackay." These, as was expected, are clearly referable to *T. Evansana*.

Meek's types of *T. Evansana* are both from Nanaimo, V.I., where they were probably collected by Mr. T. J. Turner, of the U.S. Navy, in 1856. On Vancouver Island, specimens of the same species were collected at North West Bay by Mr. Richardson in 1873, and by Mr. Harvey in 1897; at Departure Bay, by Mr. Harvey in 1901; and at Brennan Creek, near Wellington, by the Rev. G. W. Taylor in 1901. At the Sucia Islands similar specimens were collected by Mr. Richardson in 1874 and by Dr. Newcombe in 1894.

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NUCULA HORNBYENSIS, Whiteaves.

Plate 46, fig. 4.

Nucula Hornbyensis, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 122, pl. 3, fig. 2.

Original description and remarks.—"Shell of medium size for the genus, compressed convex, subelliptical in marginal outline, rather oblique and very inequilateral. Anterior or longer side obliquely subtruncated at its extremity above and rather narrowly rounded below; posterior or shorter side very regularly but narrowly rounded at the end; ventral margin broadly rounded, but rather more convex posteriorly than anteriorly; superior border nearly straight but slightly descending in front of the beaks, and sloping obliquely and much more rapidly downward behind them; beaks small, incurved and recurved, projecting very little above the highest level of the superior border, placed behind the mid-length, and in one specimen almost terminal.

"Surface almost smooth, marked only by a few faint concentric striæ of growth; test thin.

"Dimensions of the largest specimen known to the writer: length, eleven millimetres; height, eight millimetres. The specimen figured is not quite six millimetres in length.

"North-west side of Hornby Island, in the 'Middle Shales or Division D' of Mr. Richardson's Comox Section, W. Harvey, 1894: one right valve, one left valve, and a somewhat crushed specimen with both valves, each with the test preserved.

"These specimens may represent a variety of *Nucula solitaria*, but if Mr. Gabb's figure of that species is correct, it must have a very different marginal outline. His illustration represents a much more triangular shell than that of *N. Hornbyensis*, with a more prominent beak, and more pointed at both ends.

"*Nucula Traskana*, Meek, from the Cretaceous rocks of Vancouver Island, was described from a single worn cast of the interior of the shell, which has never been figured and has since been lost. Mr. Meek states that the specimen was 'probably provided with a distinct lunule,' and that 'the species will probably be recognized by its ventricose trigonal ovate form and nearly central beaks.' This description is quite inapplicable to the specimens from Hornby Island, in which the lunule and escutcheon are both obsolete."

Since this description was written, two other specimens of *N. Hornbyensis*, which are now in the Museum of the Survey, were collected at Hornby Island by Mr. Harvey in 1895. The larger of these, which is

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apparently an adult shell, is about twelve millimetres in length by ten and a half mm. in height. As will be seen by the figure on Plate 46, its marginal outline is rounded subtrigonal and very different to that of the very young and somewhat elongate specimen that was previously figured. As compared with Meek's description of *N. Traskana*, its valves are compressed rather than ventricose, and its beak is by no means central.

A left valve of a *Nucula*, from the roof of the coal at the Nanaimo mines, collected by Mr. Harvey in 1901 and now in the Museum of the Survey, has a somewhat similar outline to the adult *N. Hornbyense*. But the former, which is fifteen millimetres long and a little over twelve high, is marked with very numerous and densely crowded, but very regularly disposed concentric raised lines or minute costulæ.

Dr. Stanton, who has kindly examined all these specimens, thinks that they are quite distinct from his *Nucula Gabbi*, "from the upper part of the Knoxville beds about three miles south of Lowerys, Tehama County,"* California.

Nucula Richardsoni.

Nucula pectinata, Whiteaves. 1879. This volume, pt. 2, p. 161, pl. 18, fig. 8; but not *Nucula pectinata*, J. Sowerby, 1818.

Nucula Richardsoni, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 122.

"Shell similar to *N. pectinata*, but less inequilateral and much shorter in proportion to its height, the beaks being more nearly central, the posterior side longer and more obliquely truncated, the anterior shorter and more broadly rounded at its outer termination.

"The slightly distorted valve from the lower part of the Trent River, Vancouver Island, which was referred with doubt to the *N. pectinata* of Sowerby by the present writer in 1879, appears to be sufficiently distinct from that species to warrant the new specific name now proposed for it, in memory of its discoverer" (1896, op. cit. supra.).

Nucula (Acila) truncata, Gabb.

Nucula truncata, Gabb. 1864. Geol. Sur. Calif., Palæont., vol. I, p. 198, pl. 26, figs. 184 and 184 *a*, *b*.

Nucula (Acila) truncata, Gabb. 1869. Idem, vol. II, p. 197.

" " " Whiteaves. 1879. This volume, pt. 2, p. 162.

On Vancouver Island, specimens of this species, as determined by the writer, were collected in 1901, from the roof of the coal at the New Van-

*Bulletin of the U.S. Geographical Survey, No. 133, p. 52.

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couver Coal Co.'s mine, Nanaimo, and from ten to twelve miles up the Nanaimo River, by Mr. Harvey; also at Brennan Creek, near Wellington, by the Rev. G. W. Taylor. Similar specimens had previously been collected at Hornby Island by Mr. Harvey in 1894, and at the Sucia Islands by Dr. Newcombe in 1894 or 1896.

In the first volume of the American Journal of Conchology, published in 1865, Mr. Conrad says of *N. truncata* that "two species are evidently confounded under this name. Mr. Gabb should" (he says) "have figured a specimen from each division, as he has done in *Amauropsis alveata*."

Much more recently, in 1898, Dr. Dall says that "an examination of undoubted Cretaceous specimens of *N. truncata* shows that the species differs from the Tertiary forms by its more impressed escutcheon, its finer and more delicate divaricate sculpture, and its more prominent close set regular and even concentric sculpture. Those I have seen are also smaller."*

In a letter received in March, 1902, Dr. Stanton writes that he "doubts whether the Tejon specimens are different from the Chico ones," but that in any event the name *N. truncata* should be applied to the Chico form, because the type specimens are from Chico localities."

Yoldia diminutiva. (N. Sp.)

Plate 47, fig. 2.

Shell very small, inequilateral, moderately convex, slightly produced and narrowly rounded in front, abruptly pointed and a little longer behind; length nearly twice the maximum height; beaks small, placed a little in advance of the midlength.

Surface apparently concentrically striated.

Length, 4·7 mm.; greatest height, 2·9 mm.

Roof of coal, New Vancouver Coal Co's mine, Nanaimo, W. Harvey, 1901: a cast of the interior of a left valve with a small portion of the test preserved. This little shell differs chiefly from the *Leda translucida*, of the Californian Tertiary, as described and figured by Gabb, in its very diminutive size, the figured specimen of *L. translucida* being represented as 12 mm. long. The genus *Leda*, however, is now restricted to shells with a "long tapered bicarinate rostrum," and *Y. diminutiva* is obviously congeneric with the *Yoldia microdonta* and *Y. ventricosa* of Meek, from

* Transactions of the Wagner Free Institute of Science, Philadelphia, vol. III, pt. iv, p. 573.

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the Upper Missouri Cretaceous,* though all three seem to the writer to be more probably referable to *Yoldiella* or *Portlandia*.

Pectunculus Veatchii, Gabb. (Sp.)

Plate 47, figs 3 and 4.

Axinæa Veatchii, Gabb. 1864. Geol. Surv. Calif. Palæont., vol. I, p. 197, pl. 25, figs. 183 and 183 *a*.

" " Whiteaves. 1879. This volume, pt. 2, p. 162.

Pectunculus Veatchii, Stanton. 1896. U. S. Geol. Survey, 17th Annual Rep., pt. 1, pp. 1029 and 1039.

This is one of the commonest lamellibranchiate bivalves of the Vancouver Cretaceous. The writer has examined and studied specimens of it from the following localities, the collector's name and date at which the collections were made being added in parentheses. Vancouver Island: at Blunden Point and the entrance to Departure Bay (J. Richardson, 1872); at North West Bay (J. Richardson, 1872, and W. Harvey, 1897); from the roof of the coal at the Nanaimo mines, and ten to twelve miles up the Nanaimo River (W. Harvey, 1901); and at Brennan Creek, near Wellington (Rev. G. W. Taylor, 1901). Hornby Island (J. Richardson, 1871); Sucia Islands (J. Richardson, 1874, and Dr. Newcombe, 1894); and Texada Island (W. Harvey, 1901). All the specimens of this shell that were collected by Mr. Richardson were referred to *Axinæa Veatchii*, Gabb, by the writer, on page 162 of the second part of this volume. On the other hand, Dr. C. A. White, in 1889, identifies specimens from Sucia Island with *Axinæa sagittata*, Gabb, though with a query, as he (Dr. White) states that "none of them show the peculiar sagittate markings which suggested the name."†

The outer surface of the specimens from Texada Island is remarkably well preserved, and the finest surface markings are well shewn. These latter, when viewed with a lens, to the writer's surprise were seen to consist of a close, regular and very minute cancellation or network, consisting of densely crowded minute radiating raised lines, or low ridges with impressed lines between them, which are crossed by equally numerous, close set and minute, concentric raised lines, as represented by figure 4 on Plate 47. On a re-examination of the specimens collected long ago by Mr. Richardson, it was found that in all of those from Vancouver Island the surface is much worn and the finer markings obliterated, but that in the small specimens from the Sucia Islands the minute details of sculpture are well preserved.

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* See Report U. S. Geological Survey of the Territories, vol. IX, pp. 109 and 112, and Plates 2 and 15.

†Bulletin of the United States Geological Survey, No. 51, p. 39.

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In April last (1902) the writer sent one of the Texada specimens to Dr. Stanton, with a letter asking if any of the California examples of *P. Veatchii* in the U. S. National Museum showed the same kind of minute surface markings. In reply to this communication Dr. Stanton wrote, that "on examining our collection of *Pectunculus Veatchii*, for comparison with your specimen, I was surprised to find that almost all of our specimens have the surface sufficiently weathered to have removed the finer radiating sculpture, if they ever possessed it. A few were found, however, such as the two I am sending in the same package with yours, which retain traces of striæ that I think are comparable with those on the Texada Island shell." Both of the specimens kindly forwarded for comparison by Dr. Stanton, one from Butte Co., and the other from Pences Ranche, California, shew traces of the minute cancellation seen on Texada Island specimens. It would appear, therefore, that the *Pectunculus* from the Vancouver Cretaceous is correctly referred to *P. Veatchii*, but that exceptionally well preserved specimens of that species are marked by a minute sculpture that has not previously been described.

Dr. Dall recently * adopts the name *Glycimeris* (DaCosta, 1778) for this genus, and regards *Axinæa*, Poli (1791 and 1795) and *Pectunculus*, Lamarck (1799) as mere synonyms thereof. Still, the latter name has been in use for so many years that it seems a pity to reject it, though the laws of priority may require the change.

Arca Vancouverensis, Meek.

Arca Vancouverensis, Meek. 1857. Trans. Albany Inst., vol. IV, p. 40.
Grammatodon (?) Vancouverensis, Meek. 1876. Bull. Geol. and Geogr. Surv. Terr., vol. II, no. 4, p. 356, pl. 3, figs. 5 and 5 *a*.
Nemodon Vancouverensis, Whiteaves. 1879. This volume, pt. 2, p. 163.

The type of *Arca Vancouverensis* was collected at Nanaimo, apparently by Mr. T. J. Turner, of the U. S. Navy, in 1856. Its dimensions are stated to be: length, ·74 inch; height, ·44 inch; and breadth, ·40 inch. "This species," Meek says, "will be readily distinguished by its vertically truncated posterior extremity, and the distantly separated radiating costæ, with smaller ones between, on the anterior end. I know of no species," he adds, "with which it is liable to be confounded."

The specimens upon which the description of *Grammatodon ? Vancouverensis* was based are said to be from Comox, where they would seem to have been collected by Mr. George Gibbs in 1858. The dimensions of

* Transactions of the Wagner Free Institute of Science, Philadelphia, vol. III, p. 607.

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the specimen figured are said to be: length, 0·75 inch; height, 0·47; and breadth or convexity, 0·40 inch.

In the collections made by Sir James Hector during Captain Palliser's explorations, there are two small specimens from "Departure Bay, Nanaimo, V. I.," obtained in 1860, that are probably referable to this species.

Specimens of a small *Arca*, that may be referable to *A. Vancouverensis*, were collected at Hornby and Denman islands by Mr. Richardson, in 1872, and at Extension mine, near Nanaimo, by Mr. Harvey, in 1901. The largest of these is not quite an inch and a half in its greatest length. But it is still uncertain whether the two large single valves from Blunden Point, V. I., that are figured on plate 19 (figs. 1 and 1*a*) of the second part of this volume, and two casts of the interior of large single valves, collected on the Saable River, V. I., by Mr. Richardson, in 1872, should be regarded as adult specimens of *A. Vancouverensis*, or as a distinct species. These large shells have precisely the same kind of hinge dentition as the much smaller specimens, a character upon which Conrad based his genus *Nemodon*.

A cast of the interior of the left valve of a small *Arca* from Departure Bay, V. I., collected by Mr. Harvey, in 1901, is very similar in shape to the *Arca* (*Nemodon*) *Cumshewensis* of the Lower Shales of the Queen Charlotte Islands, but in the former the beak is curved distinctly backward.

Cucullæa truncata? Gabb. (Var.)

Cucullæa truncata? Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 196, pl. 25, fig. 182.

Cucullæa (Idonearca) truncata, Whiteaves. 1879. This volume, pt. 2, p. 165, pl. 19, figs. 2 and 2*a*.

Cucullæa truncata? (Gabb) White. 1889. Bull. U.S. Geol. Surv. No. 51, p. 38.

Cfr. *Cucullæa ponderosa*, Whiteaves. 1900. This volume, pt. 4, p. 294, pl. 38, figs. 1 and 1*a*.

In the second part of this volume the writer referred specimens of a rather large and thick shelled species of *Cucullæa*, from several localities in the Vancouver Cretaceous, to the *C. truncata* of Gabb. Similar specimens have since been collected, at the Sucia Islands, in 1894, by Dr. Newcombe; on Vancouver Island, in 1901, at Brennan Creek by the Rev. G. W. Taylor, and six or seven miles north-west of Wellington by Mr. T. Bryant; also at Yorke's Farm, two miles and a quarter to two miles and a half up the Nanaimo River, by Mr. Harvey.

But, as pointed out on pages 295 and 296 of the fourth part of this volume, "there are now some reasons for thinking that the specimens from the Nanaimo group of the Vancouver and Sucia Islands Cretaceous

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may be specifically, or at any rate varietally distinct from the true *C. truncata.*" "Through the kindness of Prof. Pilsbry, the writer has recently been able to examine and study ten authentic examples of that species, from Cottonwood Creek, the property of the Academy of Natural Sciences of Philadelphia. The largest of these specimens, however, is only forty-nine millimetres in length, by thirty-six mm. in height, inclusive of the umbones." "They seem to differ from the Maud Island specimens," (there described and figured by the writer under the name *C. ponderosa*) and from those from Vancouver and the Sucia Islands that have been referred to *C. truncata*, in their uniformly smaller size, and more particularly in their proportionately narrower and more pointed umbones. The specimens from the Vancouver Cretaceous may not be distinct from the still larger and thicker fossils from the Queen Charlotte Islands, which the writer has called *C. ponderosa*, but it is quite possible that both may be only geographical and stratigraphical varieties of *C. truncata*.

Mytilus pauperculus, Gabb.

Mytilus pauperculus, Gabb. 1864. Geol. Calif., Palæont., vol. 1, p. 183, pl. 25, fig. 165.
" " Whiteaves. 1879. This volume, pt. 1, p. 167.

A few detached valves of a small smooth *Mytilus*, that are probably referable to *M. pauperculus*, were collected on the Trent River, V.I., by Mr. Richardson in 1872; at the Sucia Islands, by Mr. Richardson in 1874 and Dr. Newcombe in 1894; and at Texada Island by Mr. Harvey in 1901. As compared with Mr. Gabb's figure of *M. pauperculus*, the specimens from these localities are proportionately a little higher, more angular at the termination of the cardinal border above, and a little less elongated.

Modiola Siskiyouensis, Gabb.

Plate 48, fig. 2.

Modiola Siskiyouensis, Gabb. 1864. Geol. Sur., Calif., Palæont., vol. 1, p. 184, pl. 30, fig. 260.

Brennnan Creek, V.I., Rev. G. W. Taylor, 1901 : a small but perfect and well preserved left valve, which is probably referable to this species. It is, however, less than half the size of the type of that species, being only eighteen millimetres and a half long, by nine and a half high, and its posterior umbonal ridge is not very clearly defined. A very imperfect and badly preserved but much larger specimen, from the roof of the coal at the Nanaimo mines, collected by Mr. Harvey, in 1901, is also probably referable to *M. Siskiyouensis*.

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MODIOLA (BRACHYDONTES). Species undeterminable.

The two specimens, one from Hornby Island, and the other from the Sucia Islands, that were referred to *M. ornata*, Gabb, on page 167 of the second part of this volume, are too small and fragmentary to be satisfactorily determined. The larger of them is only nine millimetres in length. A similar specimen has recently been collected by Mr. Harvey, from the roof of the coal at the Nanaimo mines.

LITHODOMUS NITIDUS. (N. Sp.)

Plate 48, fig. 3.

Shell moderately elongated, about twice as long as high; superior and ventral borders horizontal, straight and nearly parallel for the greater part of their length; anterior end rounded; posterior end somewhat obliquely subtruncate above and narrowly rounded below; umbones obliquely depressed, beaks anterior and nearly or quite terminal.

Surface lustrous, shining, and marked with concentric raised lines of growth. Test very thin.

Hinge dentition and muscular impressions unknown.

Roof of coal, Nanaimo mines, W. Harvey, 1901: four well preserved but imperfect and crushed specimens, none of which shew the normal and proportionate convexity of the valves.

INOCERAMUS DIGITATUS (Sowerby) Schmidt.

Inoceramus digitatus (Sowerby) Schmidt. 1873. Ueb. die Petref. der Kreide-form. von Sachalin, in Mem. Acad. Imper. des Sciences de St Pétersbourg, vol. xix, No. 3, p. 25, pl. 5, figs. 10 and 11, and the whole of plates 6 and 7.

Inoceramus undulatoplicatus (F. Roemer) Schluter. 1877. Kreide-Bivalven zur Gattung *Inoceramus*, p. 22, pl. 3, fig. 1.

" " Whiteaves. 1879. This volume, pt. 2, p. 168, pl. 20, figs. 2 and 2*a*.

Inoceramus mytilopsis, Whiteaves. 1879. Idem, p. 169, pl. 20, fig. 3; but probably not *I. mytilopsis*, Conrad, if that shell is the same as *I. labiatus*, Schlotheim.

Inoceramus digitatus (Sowerby) Jimbo. 1894. Beitr. zur Kenntniss der Fauna der Kreide-form. von Hokkaido, in Dames and Kayser's Palæont. Abhandl. (Jena), Neue Folge, Band II, heft 3, p. 43, pl. 8 (24), figs. 8-10.

" " Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 121.

The following remarks are from the publication last cited.

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"The specimens of this species collected by Mr. Richardson on Vancouver Island in 1871 and 1872, and referred to in the second part of this volume are nearly all of small size, though one individual from Blunden Point, as there stated, is fully five inches and a half in height. Some of them are higher than long, with a short hinge-line, and others longer than high, with a long hinge-line. Their sculpture also is equally variable, and consists either of continuous, concentric or radiating and divergent plications, or of corresponding rows of tubercules, in addition to the lines of growth."

"In a paper on 'Cretaceous Fossils from the Vancouver Island region,'* Dr. C. A. White doubts the correctness of the identification of the specimens collected by Mr. Richardson with *I. undulatoplicatus*, but they agree very well with Roemer's description, though perhaps not quite so well with his figure of that species.

"However this may be, several small *Inocerami*, which are evidently conspecific with those collected by Mr. Richardson, were obtained by Dr. C. F. Newcombe, in 1892, on the Comox River, V.I., and kindly presented by him to the Museum of the Geological Survey. With one exception, these specimens from Comox are all longer than high and have a long hinge-line. Their sculpture consists of concentric plications, which are rarely quite parallel with the closely and regularly disposed impressed lines of growth, upon the umbonal and central regions of each valve, and of radiating and divergent folds anteriorly.

"The only specimen collected by Dr. Newcombe on the Comox River that is higher than long, with a short hinge-line, has very peculiar sculpture. In addition to the ordinary growth-lines, a nearly central and continuous longitudinal plication runs from the beak of the left valve (the only one preserved) to the base, a little in advance of the centre of the latter. On the anterior side, five simple plications radiate obliquely forward and outward from this subcentral fold, and on the posterior side four plications, three of which are simple and one bifurcating, radiate also obliquely forward and outward from it.

"In a letter received in August (1894) the writer was informed by Mr. T. W. Stanton (of the U.S. Geological Survey) that he had been recently studying a number of specimens of *Inocerami* with divergent radiating plications, from the Niobrara shales of Colorado, that he has no hesitation in referring to the *I. digitatus* of Sowerby, as re-defined and figured by Schmidt and Schluter, and that it seems to him quite likely that *I. undulatoplicatus*, Roemer, is only the young of that species. Schluter, in his paper on the Cretaceous *Inocerami*, is, indeed, inclined to keep these two forms separate, but Schmidt (*op. cit.*) regards both *I.*

*Bulletin U.S. Geological Survey, No. 51, pt. 3, p. 37.

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undulatoplicatus, Roemer, and *I. diversus*, Stoliczka, as mere synonyms of *I. digitatus*. Mr. Stanton adds, in effect, that although none of Schmidt's figures of *I. digitatus* exactly duplicate those of *I. undulatoplicatus* in the 'Mesozoic Fossils,' it still seems to him most likely that the Vancouver specimens are young individuals of *I. digitatus*, a conclusion in which the present writer entirely concurs."

Similar specimens were collected in 1901, at Extension Tunnel, near Nanaimo, by Mr. Harvey; and at Brennan Creek, V.I., by the Rev. G. W. Taylor. One of these specimens from Extension, which is nearly four inches and a quarter high, and apparently about as long as high, is very similar to some of the Saghalien specimens of *I. digitatus* that are figured by Dr. Schmidt. A fragment of a valve that is probably referable to this species and that shows its characteristic surface markings, was collected at the west end of Lasqueti Island by Dr. G. M. Dawson in 1885.

The specimen from Blunden Point collected by Mr. Richardson in 1872, and the two specimens from Extension recently collected by Mr. Harvey, are the only large ones from Canada that the writer has seen, though small ones, that are not much more than two inches in their greatest diameter, and usually less, are not uncommon in the Vancouver Cretaceous.

A few small specimens, with numerous fine concentric ridges but no indications of any divaricating plications, that were referred to *I. mytilopsis*, Conrad, in the second part of this volume, were collected at the Trent River and Bradley Creek, V. I., by Mr. Richardson, in 1872.* They are probably young specimens of *I. digitatus* in which the divaricating plications are not yet developed, such as are figured by Schmidt on Tafel VII, figs. 8, 9 and 10, of his memoir on the Cretaceous rocks of Saghalien. Similar specimens were collected on the Puntledge River, near Comox, by Dr. Newcombe and Mr. Harvey, in 1892.

The specimen from the Nanaimo River referred to by Mr. Etheridge as "No. 22, *Inoceramus mytilopsis*," in one of the lists of fossils in Sir James Hector's paper "On the Geology of the Country between Lake Superior and the Pacific Ocean," and in Captain Palliser's official report, as elsewhere stated,† is a very small right valve of *Inoceramus Vancouverensis*.

INOCERAMUS SUBUNDATUS, Meek.

Inoceramus subundatus, Meek. 1861. Proc. Acad. Nat. Sc. Philad., vol. XIII, p. 315.
Inoceramus Crippsii? var. *subundatus*, Meek. 1876. Bull. Geol. and Geogr. Surv. Terr., vol. II, No. 4, p. 358, pl. 3, figs. 1 and 1 *a*, 3 and 3 *a*.

*Not 1871, as inadvertently stated on page 169 of the second part of this volume.

†In the Transactions of the Royal Society of Canada for 1895, Second Series, vol. I, sect. IV, p. 112.

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Inoceramus Crippsii, var. *proximus*, Whiteaves. 1879. This volume, pt 2, p. 172.
" var. *Suciensis*, Whiteaves. 1879. Idem, p. 173.
" var. *Barabini*, Whiteaves. 1879. Ibid. p. 173.

Inoceramus subundatus (Meek) Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 112.

The specimens of this species that were described and figured by Meek, are from Comox, V. I., and the Sucia Islands, where they would appear to have been collected by Mr. George Gibbs in 1858. Among the collections made by Sir James Hector, in 1860, during Captain Palliser's explorations, there are four small slabs of argillaceous shale from the Nanaimo River which have upon one or both sides numerous small valves which correspond very well with Meek's illustrations of *I. subundatus*. Mr. Richardson obtained specimens of it at Denman Island in 1891; two miles and a quarter up the Nanaimo River, in the lower part of the Trent River, and at Blunden Point, V.I., in 1872. At the Sucia Islands, specimens were collected by Mr. Richardson in 1874, and by Dr. Newcombe in 1894.

Inoceramus Vancouverensis, Shumard.

Inoceramus Vancouverensis, Shumard. 1858. Trans. Acad. Sc. St. Louis, vol. I, p. 123.
Inoceramus unduloplicatus, Etheridge. 1861. In Hector's paper, Quart. Journ. Geol. Soc. London, vol. XVII, p. 434; but not *I. undulatoplicatus*, Roemer, 1852.

Inoceramus mytiloides, Etheridge. 1861. Idem, p. 34; but not *I. mytiloides*, Mantell, 1852.
Inoceramus Vancouverensis, Whiteaves. 1879. This volume, pt. 2, p. 170, pl. 20, figs. 4, 4 *a* and 4 *b*.

Inoceramus Nebrascensis, var. *Sagensis*, Whiteaves. 1879. Idem, p. 172 (a typ. err. for *I. Sagensis*, var. *Nebrascensis*); but probably not *I. Nebrascensis*, Owen.
Inoceramus Vancouverensis, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 111.

The types of *I. Vancouverensis* are said to have been collected at Nanaimo by Dr. John Evans, U. S. Geologist, and they obviously could not have been obtained later than 1857.

As stated in the Transactions of the Royal Society of Canada for 1895, (op. cit. supra), in one of the collections made during Captain Palliser's explorations there are three specimens which are apparently referable to *I. Vancouverensis*. One of these is a very imperfect left valve labelled "No. 20, *Inoceramus undulato-plicatus*, septarian clay (above the lignite), Nanaimo River, Dr. Hector, 1860." The umbo of this valve is not so tumid as is usual in this species, and the surface markings consist of low, distant, concentric undulations, but there are no indications of any radia-

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ting and divaricating folds. The other two are very small right valves from essentially the same locality, one labelled "No. 22, *Inoceramus mytilopsis*," and the other "*Isocardium*." Both have the prominent umbo characteristic of *I. Vancouverensis*, and the latter evidently corresponds to the latter part of the entry, "Also *Nautilus* and *Incardium*" (a typographical error for *Isocardium*), after No. 29 in the list of specimens on page 243 of Captain Palliser's report.

The right valve from the Sucia Islands referred to *I. Sagensis*, var. *Nebrascensis*, on page 172 of the second part of this volume, is a broad variety of *I. Vancouverensis*.

In 1871–75, specimens of this species were collected by Mr. Richardson two miles and a-half up the Nanaimo River, V. I., at Protection, Salt Spring (or Admiralty), Saturna, and the Sucia Islands; also in 1901, by Mr. Harvey, at Yorke's Farm, two miles and a quarter to two miles and a half up the Nanaimo River.

Pecten Traskii, Gabb.

Pecten Traskii, Gabb. 1864. Geol. Surv. of Calif., Palæont., vol. I, p. 200, pl. 26, fig. 187; and (1869) vol. II, p. 198, pl. 32, fig. 95.

Texada Island, W. Harvey, 1901: one small lower valve.

Lima Suciensis. (N. Sp.)

Plate 51, fig. 2.

Shell small, moderately convex but slightly compressed, obliquely subovate, posterior side somewhat produced below, larger and more narrowly rounded than the anterior; beaks incurved, ears small.

Surface markings consisting of small, narrow, radiating ribs, that are everywhere crossed by concentric striæ or lines of growth. From eleven to fourteen of these ribs are a little larger than the rest, and in testiferous specimens the spaces between them, when examined with a lens, are seen to be occupied by from four to six low and close-set, minute, radiating ridges. Characters of the interior of the valves unknown.

Sucia Islands, Dr. C. F. Newcombe, 1876: three casts of the interior of both valves. Extension mine, near Nanaimo, W. Harvey, 1901: a cast of a left valve. Texada Island, W. Harvey, 1901: an imperfect but testiferous left valve. The largest of these is less than one inch in its greatest diameter.

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LIMA. (Species indeterminable.)

A single specimen of a rather large species of *Lima*, apparently of the *Plagiostoma* group, collected by Mr. Richardson, in 1872 (not 1871), at the entrance to Departure Bay, V.I., was referred to *L. multiradiata*, Gabb, with a query, on page 174 of the second part of this volume. This identification, however, is far from satisfactory, as only a very small piece of the test is preserved on the Canadian fossil.

Two very similar specimens, except that they are mere casts of single valves, without any portion of the test preserved, were collected by Mr. Harvey, in 1901, at Extension mine, three miles south-west of Nanaimo, V.I. Both of these casts, which are now in the Museum of the Survey, are marked by very numerous, narrow, radiating ribs. In one of them, seven or eight of the ribs are a little larger than the rest, and in the other the ribs are rather irregular in size and distribution.

SPONDYLUS. (Species uncertain.)

Cfr. *Spondylus fragilis*, Stanton. 1896. Bull. U. S. Geol. Surv. No. 133, p. 35, pl. II, fig. 3.

Among the fossils collected during Captain Palliser's explorations a "small piece of glauconitic rock labelled No. 48 (below the Lignite), Departure Bay, Nanaimo; *Ostrea bella*, Conrad; Dr. Hector, 1860; coll., Mr. Mackay—contains a few valves or fragments of valves of a species of *Ostrea*, and a single valve of a shell whose generic and specific relations are uncertain. This valve is sixteen lines and a half in length and about fourteen and a half in breadth. It is moderately convex, but with a rather broad, shallow, transverse constriction a little in front of the mid-length, obliquely subovate in outline, a little longer than broad, and the extremely thin test is marked with fine radiating raised lines, about three in the breadth of a millimetre, which are minutely bifurcating anteriorly, when viewed with a lens. It is much more finely ribbed than the convex valve of *Ostrea bella*, if Conrad's figures are correct, and indeed its surface markings are not at all like those of an *Ostrea*. A fragment of a much larger specimen in the collection, from the same locality and apparently belonging to the same species, has essentially the same sculpture on the *interior* of the shell as the *Spondylus complanatus* of d'Orbigny,* from the French Neocomien. Another specimen in the collection, from the same locality and possibly also belonging to the same species, is the No. 41 of the list of specimens on page 243 of Capt. Palliser's report. It is a rough cast of the interior of one valve, about

*Paléontologie Française, Terr. Crét., vol. III, p. 657, pl. 451, figs. 7-10.

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two inches and a quarter in length and an inch and a half in its greatest breadth. It is longitudinally subovate, but rather irregular in outline, its umbonal region is prominent, and its surface shows impressions of somewhat narrow, flexuous, radiating ribs." *

These three specimens, and the two collected at practically the same locality by Mr. Richardson, and referred to on page 175 of the second part of this volume as "HINNITES or SPONDYLUS (Sp. Undt.)," agree fairly well with Dr. Stanton's description and figure of *S. fragilis*, but they are too imperfect and badly preserved to be determined with much certainty. Similar but better specimens, now in the Museum of the Survey, were collected at Extension mine, near Nanaimo, by Mr. Harvey, in 1900, and apparently in the same kind of rock.

EXOGYRA PARASITICA, Gabb.

Exogyra parasitica, Gabb. 1864. Geol. Surv. Calif., Palæont., vol. I, p. 205, pl. 26, figs. 192 and 192 *a*, *b*; and pl. 31, figs. 273 and 273 *a*.

Exogyra (Sp. undt.) Whiteaves. 1879. This volume, pt. 2, p. 175.

The single valve of an *Exogyra* from the entrance to Departure Bay, referred to on page 175 of the second part of this volume, and two specimens with both valves since collected at the Sucia Islands by Dr. Newcombe (in 1896) are probably referable to *E. parasitica*, though in one of the latter, a part at least of the attached valve is radiately costate.

GRYPHÆA VESICULARIS, Lamarck.

Ostrea vesicularis, Lamarck. 1806. Ann. Mus., vol. VIII, p. 160, pl. 22, fig. 3; and (1819) Hist. An. Sans Verteb., vol. VI, p. 219.

" " Goldfuss. 1826. Petref. Germ., vol. I, p. 23, pl. 81, fig. 2.

" " D'Orbigny, Pal. Franc., Terr. Crétac., vol. III, p. 742, pl. 487, figs. 1 and 2, but not figs. 6, 8 and 9.

Ostrea convexa, Say. 1820. Amer. Journ. Sc. and Arts, vol. II, p. 42.

Gryphæa convexa, Morton. 1828. Journ. Ac. Nat. Sc. Philad., vol. VI, p. 79, pl. 4, figs. 1 and 2, and pl. 5, figs. 1-3; also (1834) Synops. Org. Rem. Cret. Gr. U. S., p. 53, pl. 4, figs. 1-2.

Gryphæa mutabilis, Morton. 1828. Journ. Ac. Nat. Sc. Philad., vol. VI, p. 81, pl. 4, fig. 3: and (1834) Synops. Org. Rem. Cret. Gr. U. S., p. 53, pl. 4, fig. 3.

Gryphæa vesicularis, Meek. 1876. Rep. U.S. Geol. Surv., Terr., vol. IX, p. 20 (which see, for several European and U. S. synonyms, not included in this list), pl. 11, figs. 2 *a*, *b*, *c*, and pl. XVI, figs. 8, *a-b*.

Gryphæa vesicularis, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. IV, p. 120.

"Howe Sound, Mr. J. Fannin, 1884: one lower valve, about fifty-one millimetres long and fifty-seven broad. It is ovately subtriangular in

*Transactions of the Royal Society for 1895, Second Series, vol I, sect. IV, pp. 110, 111.

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outline, broader than long, and its posterior side is produced and somewhat pointed below. Nanaimo, V.I., two specimens; one a very gibbous lower valve, sixty-five mm. long and forty-two broad; the other, seventy millimetres in length by forty-nine in breadth, with both valves preserved *in situ*, but with a much less convex lower valve; both of them elongate subovate in marginal outline and almost equilateral. In two of the specimens the lower valve is strongly and regularly convex, but it is not lobed posteriorly by a distinct longitudinal groove or sinus on or near the front margin, in either of the three.

"These free and narrowly convex shells look very different to the broad, irregularly subhemispherical specimens, with a broad surface of attachment to the umbo of the lower valve, from the Fort Pierre group of the Dakota Cretaceous, which Mr. Meek referred with some doubt to *O. vesicularis*. Still they correspond fairly well with Goldfuss' description and figures of the typical form of that species, which he calls the "var. *A.*," and describes as "*testa rostrata libera*;" also with Morton's figures of *G. convexa*, Say, and with one of Stoliczka's figures (Cret. Faun. S. India, pl. 42, fig. 4) of *O. vesicularis*" (1896, op. cit. supra).

Anomia Vancouverensis, Gabb.

Anomia Vancouverensis, Gabb. 1869. Geol. Calif., Palæont., vol. II, p. 202, pl. 33, fig. 102.
" " Whiteaves. 1879. This volume, pl. 2. p. 175.

Two upper valves of a small species of *Anomia*, that are probably referable to *A. Vancouverensis*, were collected at Texada Island by Mr. Harvey in 1901. Both are irregular in outline and marked only with concentric lines of growth, while the beak of each is very nearly marginal.

BRACHIOPODA.

Rhynchonella Suciensis, Whiteaves.

Plate 51, figs. 3, 3 *a* and 4.

Rhynchonella (Sp. undt.). Whiteaves. 1879. This volume, pt. 2, p. 177.
Rhynchonella Suciensis, Whiteaves. 1896. Trans. Royal Soc. Canada for 1895, Second Series, vol. I, sect. iv, p. 119, pl. 3, fig. 1.

The original description of this species is as follows:—

"Shell moderately convex, subovate, with an apparently feebly developed mesial fold and sinus. Ventral valve a little longer than broad, with a narrow, elongated and nearly straight beak; dorsal valve broader than long, with a comparatively obtuse and incurved beak. Surface markings of both valves consisting of numerous (about twenty-two) narrow, pro-

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minent, acute raised ribs, which extend from the beaks to the anterior margin.

"Sucia Islands, J. Richardson, 1874, one rather small but perfect specimen and two single valves; and Dr. C. F. Newcombe, 1894, six single valves."

The largest of these specimens, it may be added, is not quite seventeen millimetres in its maximum diameter, and it is now obvious that none of them are quite full grown.

A few badly preserved specimens of a *Rhynchonella*, which are probably referable to this species and which are now in the Museum of the Survey, were collected at three different localities on Vancouver Island in 1901. Four of these are from Brennan Creek, where they were collected by the Rev. G. W. Taylor. The largest of them is the original of figures 3 and 3 *a* on Plate 51. It is transversely subelliptical, wider than high, about 25·5 mm. wide by 20·5 high, and has upwards of thirty ribs. In this specimen and in another apparently adult shell from the same locality, there is no mesial fold or sinus. One small specimen, about 10 mm. long and slightly longer than wide, with very fine ribs, from Departure Bay, and another, a little larger and rather more coarsely ribbed specimen, from the roof of the coal at the New Vancouver Coal Company's mine, were collected by Mr. Harvey.

A crushed specimen of a *Rhynchonella* from Tucker Bay, Lasqueti Island, collected by Mr. Harvey in 1901 and now in the Museum of the Survey, is probably only a rather coarsely ribbed variety of *R. Suciensis*. It is 20·5 mm. long by 20 broad, and has only fifteen or sixteen ribs.

Terebratella Harveyi. (N. Sp.)

Plate 51, figs. 5 and 6.

Shell inequivalve, minutely punctate, subcircular or somewhat fan-shaped, rounded in front and at the sides, but bluntly pointed behind.

Ventral valve deeper and a little larger than the dorsal, its umbo moderately prominent or produced, and its surface marked with from twelve to fourteen simple or bifurcating ribs or rib-like folds, and concentric lines of growth. The beak, or apex of the umbo, and the foramen and area of this valve are not preserved in any of the specimens that the writer has seen, but a cast of the interior of a ventral valve shews a transverse constriction of the umbo, and a narrow divergent groove or slit on each side of it.

Dorsal valve nearly flat, its cardinal border straight, its beak very small, and its surface ornamentation similar to that of the ventral. A cast of

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the interior of the dorsal shews only a fine, linear, median groove, extending longitudinally from the beak almost to the midlength, and indicating a rather short mesial septum.

Extension mine, Nanaimo, eleven imperfect specimens; and Texada Island, four similar specimens; all collected by Mr. Harvey in 1901.

KINGENA OCCIDENTALIS. (N. Sp.)

Plate 51, figs. 7 and 7 *a*.

Terebratula Wacoensis, Whiteaves. 1879. This volume, pt. 2, p. 177; but probably not *T. Wacoensis*, Roemer, 1852.

Shell compressed convex, broadly subelliptical and somewhat pentagonal, a little longer than wide and about twice as wide as high (or deep), subtruncate in front and bluntly pointed behind.

Ventral valve not much more convex exteriorly than the dorsal, the umbo of the former short, obtuse, and very slightly incurved, but its apex or beak is unfortunately broken off in the only specimen collected. Dorsal valve with a very small and slightly incurved beak, which is divided interiorly and longitudinally by a median septum, that extends about half way to the front margin. Surface everywhere minutely punctate, when examined with a lens.

Approximate dimensions of the only specimen known to the writer: maximum length, about sixteen millimetres: greatest breadth, about fourteen mm.; maximum convexity of both valves when closed, seven mm.

Trent River, V. I., J. Richardson, 1871: the specimen referred to in the second part of this volume, which was provisionally identified with the *Terebratula Wacoensis* of Roemer, which Schuchert has shown to be a *Kingena*. A subsequent comparison of this fossil with numerous authentic Texan examples of *K. Wacoensis*, presented to the Museum of the Survey by Prof. R. J. Hill, in 1889, has, however, led to the conclusion that the former should be regarded as a probably distinct and previously undescribed species, characterized chiefly by its smaller size, narrower and less convex lateral margins, and much more strongly compressed valves. Dr. Stanton and Mr. Schuchert, who have examined and studied the specimen upon which the foregoing description is based, agree in thinking that it is distinct from *K. Wacoensis*. The marginal contour of *K. occidentalis* is somewhat similar to that of the form of *K. lima* represented by Davidson on plate IV, figs. 24, 24*a*, and 24*c*, of the British Cretaceous Brachipoda, published by the Palæontographical Society, but the valves of the former are much more compressed, and the umbo of its ventral valve is less incurved.

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POLYZOA.

A badly preserved specimen of the zoarium of a cheilostomatous polyzoon that Mr. R. S. Bassler, of the U. S. National Museum, thinks is a *Membranipora* of the *M. membranacea* group, was collected at Brennan Creek, V.I., by the Rev. G. W. Taylor in 1901.

ECHINODERMATA.

All the echinoderms from the Vancouver Cretaceous that the writer has yet seen, are a few fragments.

The Echinoidea are represented by two or three small pieces of the test of a regular echinid, from Departure Bay, V.I., collected by Mr. Harvey in 1901. These fragments, which in some respects are like portions of the test of a *Pseudodiadema*, shew two vertical rows of small tubercles alternating with the ambulacra. In *Pseudodiadema* the tubercles are both crenulated and perforate, but in the fragments from Departure Bay, although the tubercles are clearly perforate, the outer surface is so much worn that it is doubtful whether they are crenulated or not.

The Starfishes are represented by a specimen shewing most of the calcareous plates of one ray of a five-rayed species from Lasqueti Island, collected by Dr. G. M. Dawson in 1885. In reference to this specimen Dr. J. W. Gregory writes as follows, in a letter dated July 18, 1899. "It is no doubt a starfish of the family Pentagonasteridæ and a close ally of the genus *Calliderma*. But I believe it to indicate a new genus characterized by the smaller size of the marginal plates, and almost equal size of the internal plates. The pedicellariæ also are different. If at any time more specimens are forthcoming, shewing especially the external form, I should be glad to do more with the fossil. A very little more would have enabled me to form a tolerably definite idea whether the rays were much prolonged or not."

The Crinoidea are represented by a single five-lobed joint of the column of a Pentacrinite, and a fragment of the basal portion of the dorsal cup of a Pentacrinite or some other crinoid, both on the same small piece of rock, which was collected at Lasqueti Island by Mr. Harvey in 1901.

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ANTHOZOA.

SMILOTROCHUS (?) VANCOUVERENSIS.

Smilotrochus Vancouverensis, Whiteaves. 1879. This volume, pt. 2, pl. 20, figs. 7 and 7*a*.

The type and only known specimen of this species at that time, was collected at Hornby Island, by Mr. Richardson, in 1871. Of later years a fine specimen of *S. Vancouverensis* has been collected at the same locality by Mr. Harvey, in 1895.

ERRATA.

Page 312.
Line 21, from top, for "Upper Missouri County,"—read—Upper Missouri country.

Page 316.
Line two, from bottom, for "specimen No. 4,"—read—specimen No. 2.

Page 321.
Line three, from bottom, for—"from the same stone,"—read—from the same stone or stones.

Page 338.
Line 20 from top, for "*Hamites subcompressum*,"—read—*Hamites subcompressus*; and on
Line 24, from top, for "*Hamites (Anisocras) subcompressum*,"—read—*Hamites (Anisoceras) subcompressus.*

Page 367.
Line 18, from top, for "Var. *carinifera*,"—read—Var. *cariniferus.*

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List of fossils from the Nanaimo group of the Vancouver Cretaceous, exclusive of plant remains.*

FISHES.

Vertebræ of a teleost.
Asterospondylic vertebra of shark.
Lamna appendiculata, Agassiz.

CRUSTACEA.

DECAPODA.

Plagiolophus Vancouverensis, H. Woodw.
Palæocorystes Harveyi, H. Woodw.
Callianassa Whiteavesii, H. Woodw.
Hoploparia Bennetti, H. Woodw.
Enoploclytia minor, H. Woodw.
Eryma Dawsoni, H. Woodw.
Meyeria (?) Harveyi, H. Woodw.
Glyphæa, sp. nov.
Linuparus Vancouverensis.
Linuparus Canadensis.

MOLLUSCA.

CEPHALOPODA.

Belemnites, sp. indet.
Nautilus Campbelli, Meek.
" Suciensis.
Phylloceras ramosum, Meek.
" Forbesianum (d'Orbigny).
Gaudryceras Maclurei (White).
" Denmanense.
Tetragonites Timotheanus? (Mayor).
Pseudophyllites Indra (Forbes).
Heteroceras elongatum.
" Hornbyense.
Hamites obstrictus, Jimbo.
Diplomoceras notabile.
Ptychoceras Vancouverense.
Anisoceras subcompressum (Forbes).
Anisoceras Cooperi (Gabb).
Baculites Chicoensis, Trask.
Hoplites Vancouverensis (Meek).
Pachydiscus Otacodensis (Stoliczka).
" Neevesii.
" Suciensis (Meek).
" Haradai, Jimbo.
" (Haradai, var. ?) perplicatus.
" binodatus.
" Newberryanus (Meek).
" multisulcatus.
Desmoceras Selwynianum.
Pleuropachydiscus Hoffmanni (Gabb). Var.
Hauericeras Gardeni (Bailey).

GASTEROPODA.

Cylichna costata, Gabb.
Haminea Hornii? (Gabb).
Cinulia obliqua, Gabb.
Cinuliopsis typica.
Trochactæon semicostatus.
Surcula Suciensis.

* The species to which no author's name is appended have either been described by the writer in previous publications, or are now for the first time described in this Report

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Surcula (raricostata ? var.) Hornbyensis.
Bela cretacea.
Rostellites Gabbi (White).
Fusus Kingii, Gabb.
Serrifusus Dakotensis, var. Vancouverensis.
Perissolax brevirostris, Gabb.
Hindsia nodulosa.
Sycodes glaber (Shumard).
Cypræa Suciensis.
Tessarolax distorta, Gabb.
Anchura callosa.
" exilis, Gabb.
Mesostoma Suciense.
Mesostoma (?) intermedium.
Mesostoma (?) Newcombii.
Cerithium Vancouverense.
" Harveyi.
Potamides tenuis, Gabb.
Potamides tenuis, var. Nanaimoensis.
Nerinea dispar, Gabb. Var.
Littorina compacta ? Gabb.
Capulus corrugatus.
Vanikoro pulchella. Var.
Vanikoropsis Suciensis, White.
Lunatia Shumardiana ? Gabb.
Gyrodes Conradiana, Gabb, var. Canadensis.
Amauropsis Suciensis.
Odostomia (?) inornata.
" (?) cretacea.
Lysis Suciensis.
Anisomyon Meekii, Gabb.
Acmæa (?) sp. indet.
Scalaria Mathewsoni, Gabb.
Cirsotrema tenuisculptum.
Eunema cretaceum.
Margarita ornatissima (Gabb).
Solariella (radiatula ? Forbes, var.) occidentalis.
Phaneta (?) decorata.
Helcion giganteus, Schmidt, var. Vancouverensis.
Helcion tenuicostatus.
Genus & species uncertain.

SCAPHOPODA.

Dentalium Nanaimoense, Meek.
Entalis Cooperi (Gabb).

PELECYPODA.

Teredo Suciensis.
Martesia clausa, Gabb.
Martesia parvula.
Corbula Traskii, Gabb.
" minima ? d'Orbigny.
Panopæa concentrica, Gabb.
Cymbophora Ashburneri, Gabb.
Anatina sulcatina ? Shumard.
" quadrata, Gabb.
" Tryoniana, Gabb.
" subcylindracea.
Thracia occidentalis, Meek.
" subquadrata, Meek.
Pholadomya subelongata, Meek.
Goniomya borealis, Meek.
Cuspidaria Suciensis.
Tellina quadrata, Gabb.
" occidentalis.
" Nanaimoensis.
Asaphis multicostata, Gabb.
Linearia (Leiothyris) Meekana.
Meretrix nitida, Gabb.
" arata, Gabb.
Dosinia inflata, Gabb.
" gyrata ? Gabb.
Cyprimeria tenuis, Meek.
" lens.
Cyprina Denmanensis.
Cyprina (?) anthracicola.
Veniella crassa.
Protocardia scitula, Meek.
Lævicardium Suciense.
Lucina nasuta ? Gabb.
" subcircularis, Gabb.
Thyasira cretacea.
Clisocolus dubius, Gabb.
" cordatus.
Crassatella Conradiana, Gabb.
Crassatella Conradiana, var. Tuscana.
Eriphyla umbonata, Gabb.
Opis Vancouverensis.
Unio Nanaimoensis.
Trigonia Evansana, Meek.
" Tryoniana, Gabb.
Nucula Traskana, Meek.
" Hornbyensis.

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Nucula Richardsoni.
Nucula (Acila) truncata, Gabb.
Yoldia striatula, Forbes.
" diminutiva.
Pectunculus Veatchii (Gabb).
Arca Vancouverensis, Meek.
Arca (Cucullæa ?) equilateralis, Meek.
Cucullæa truncata, Gabb.
Pinna calamitoidea, Shumard.
Mytilus pauperculus, Gabb.
Modiola Siskiyouensis, Gabb.
Modiola (Brachydontes) sp. indet.
Lithodomus nitidus.
Perna excavata, White.
Inoceramus digitatus (Sowerby) Schmidt.
" subundatus, Meek.
" Vancouverensis, Shumard.
Meleagrina antiqua, Gabb.
Pecten Traskii, Gabb.
Lima Suciensis.
Lima, sp. indet.
Spondylus, sp. indet.
Exogyra parasitica, Gabb.
Gryphæa vesicularis, Lamarck.
Anomia Vancouverensis, Gabb.

BRACHIOPODA.

Rhynchonella Suciensis.
Kingena occidentalis.
Terebratella Harveyi.

POLYZOA:

Membranipora, sp. indet.

ECHINODERMATA.

Fragments of test of a regular echinid.
Portion of ray of a five-rayed starfish.
Five lobed joint of column of Pentacrinite.

ANTHOZOA.

Smilotrochus Vancouverensis.

OTTAWA, November 5, 1902.

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INDEX TO GENERIC AND SPECIFIC NAMES.

(Synonyms in Italics.)

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PLATE XL.

LINUPARUS VANCOUVERENSIS (page 323).

Figure 1. Dorsal view of the type of this species, from the Puntledge or Comox River, near Comox, V. I.

Figure 2. The specimen referred to in the text as No. 4, which shews the interior of the cephalothorax, five of the abdominal segments, etc.

Figure 3. Dorsal view of a specimen in the split nodule from Hornby Island, referred to on page 325 as No. 55 *a* and *b*.

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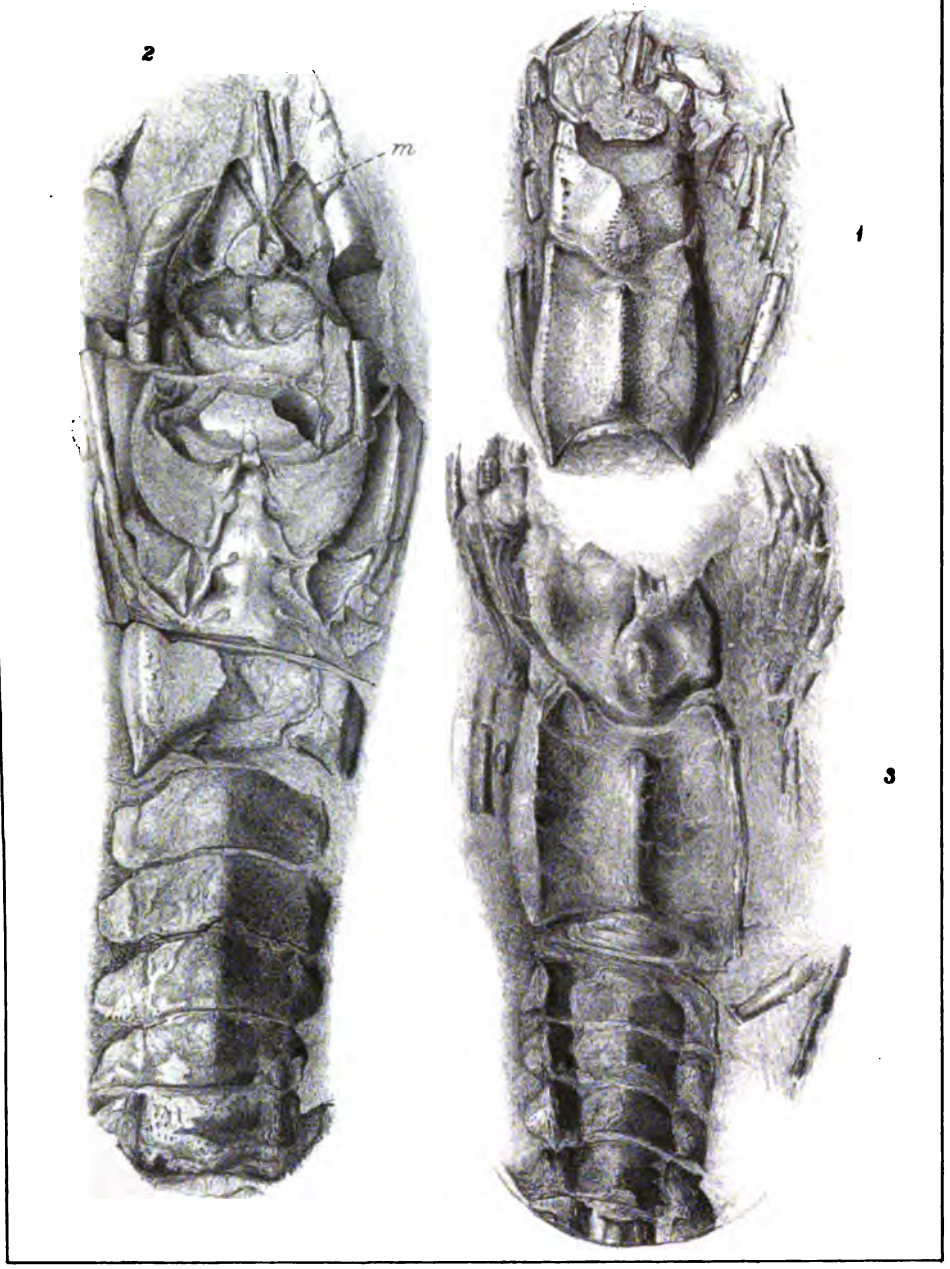

G M Woodward & H.B Potter. West, Newman imp.

Decapod Crustaceans
U. Cretaceous Vancouver Island, B.C.

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PLATE XLI.

LINUPARUS CANADENSIS (page 325).

Figure 1. The specimen from Hornby Island referred to on page 326 as No. 55 *c*, which Dr. Woodward identifies with this species.

ERYMA DAWSONI (page 321).

Figure 2. Profile view of the type and only known specimen of this species, from Hornby Island.

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G M Woodward & H.B. Potter

West, Newman imp.

Decapod Crustaceans
U. Cretaceous Comox & Hornby Id. B.C.

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PLATE XLII.

HETEROCERAS HORNBYENSE (page 332).

Figure 1. One of the two original and dextral types of this species, shewing only the spirally coiled portion of the shell.

Figure 2. Part of the spirally coiled portion of a sinistral specimen, the type of *H. perversum*.

Figure 3. Spirally coiled portion of another sinistral specimen.

Figure 4. The largest specimen known to the writer, shewing part of the spirally coiled portion, and the free, deflected and abruptly bent or hook-shaped part of the shell, as described on page 333.

All the specimens figured on this plate are from Hornby Island.

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PLATE XLIII.

ANISOCERAS COOPERI (page 336).

Figure 1. Side view of the specimen from Hornby Island collected by Mr. Robbins, and referred to in the last line on page 337, and the first and second lines on page 338.

HINDSIA NODULOSA (page 357).

Figure 2. Ventral view of a specimen from the Sucia Islands, belonging to Dr. Newcombe, that shews the characters of the aperture unusually well.

PERISSOLAX BREVIROSTRIS (page 356).

Figure 3. Dorsal view of the most perfect specimen that the writer has seen, from the Sucia Islands, the property of Dr. Newcombe.

MESOSTOMA (?) INTERMEDIUM (page 360).

Figure 4. One of the best specimens of this species, from the Sucia Islands, twice the natural size.

MESOSTOMA (?) NEWCOMBII (page 361).

Figure 5. Dorsal view of the only specimen of this species known to the writer, from the Sucia Islands.

CERITHIUM VANCOUVERENSE (page 361).

Figure 6. Dorsal view of the type of this species, from Extension mine, near Nanaimo, V.I., twice the natural size.

CERITHIUM HARVEYI (page 362).

Figure 7. One of the specimens from Nanaimo referred to in the text, twice the natural size.

ODOSTOMIA (?) INORNATA (page 366).

Figure 8. Dorsal view of the only specimen known to the writer, from the Nanaimo River, three times the natural size.

ODOSTOMIA (?) CRETACEA (page 366).

Figure 9. Apertural view of an average specimen from Brennan Creek, V. I., in outline and four times the natural size.

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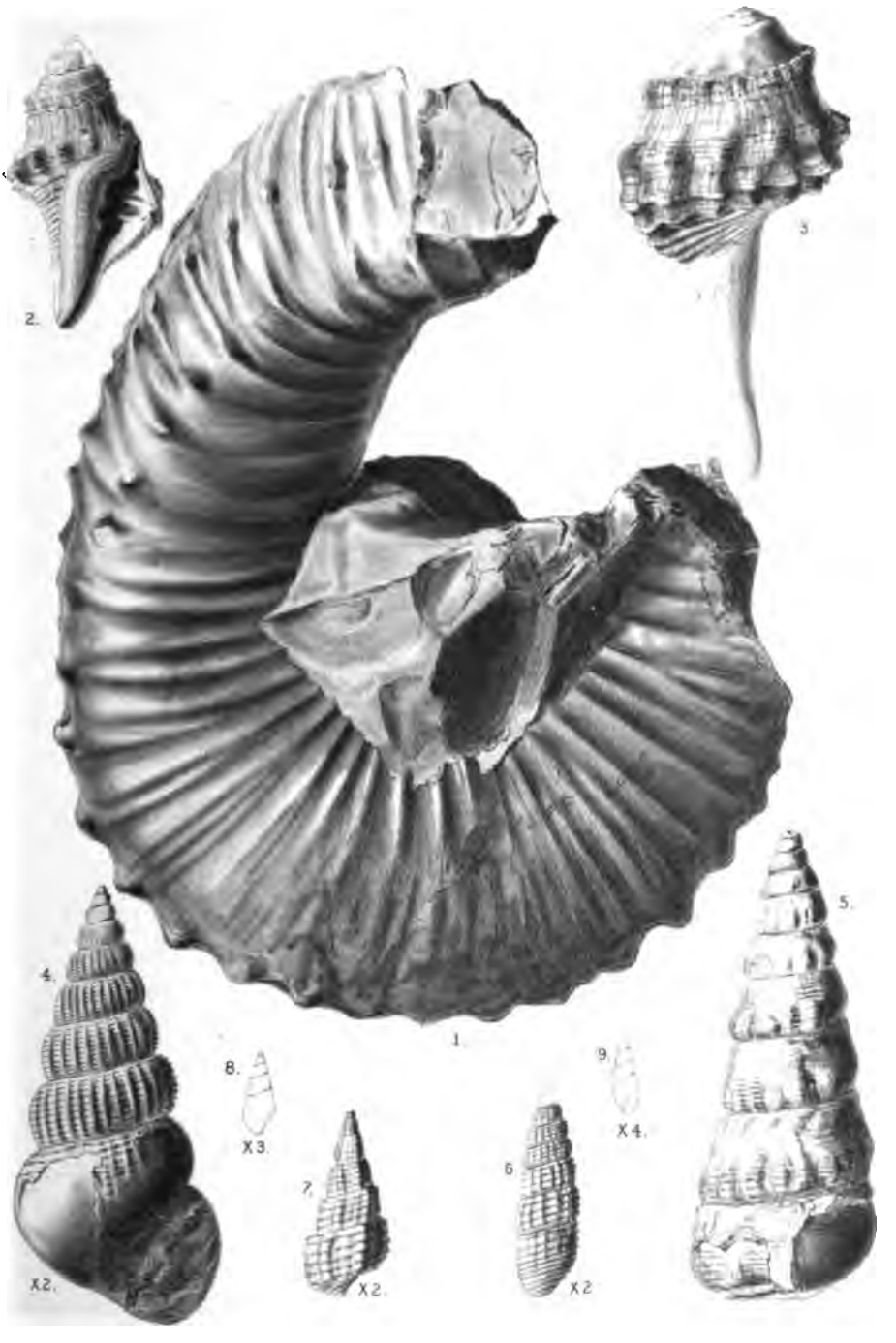

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PLATE XLIV.

ASTEROSPONDYLIC VERTEBRA (page 314).

Figure 1. The centrum from the Puntledge River referred to in the text.

From a drawing by Mr. C. Frank King.

HETEROCERAS ELONGATUM (page 331).

Figure 2. The spiral and closely coiled portion of a sinistral specimen from Hornby Island.

HAMITES OBSTRICTUS (page 334).

Figure 3. Side view of the best specimen that the writer has seen, from Hornby Island..

From a drawing by Mr. F. E. Calderon.

DIPLOMOCERAS NOTABILE (page 335).

Figure 4. Side view of the specimen described, from Hornby Island, seven twelfths the natural size. The sutural lines are exposed on the other side and are best seen at *a*.

" 4 *a*. Outline of transverse section of the same, also seven twelfths the natural size.

" 4 *b*. Sutural line of the same, as far as it can be ascertained, of the natural size.

From a drawing by Mr. C. Frank King.

TROCHACTÆON SEMICOSTATUS (page 354).

Figure 5. Dorsal view of a specimen from Nanaimo, four times the natural size.

BELA CRETACEA (page 355).

Figure 6. Dorsal view of one of the specimens from Hornby Island, twice the natural size.

MESOSTOMA SUCIENSE (page 359).

Figure 7. Part of a specimen from the Sucia Islands, collected by Dr. Newcombe, with the aperture well preserved.

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PLATE XLV.

ANISOCERAS SUBCOMPRESSUM (page 338).

Figure 1. Side view of a specimen from the Puntledge River, near Comox, V.I.

" 1 *a*. Outline of a transverse section of the straighter part of the same, a little behind the midlength of the specimen.

" 1 *b*. Outline of a similar section, near the anterior end of the specimen.

All from drawings by Mr. C. Frank King.

CAPULUS CORRUGATUS (page 364).

Figure 2. A specimen from the Puntledge River, as seen from above.

" 2 *a*. Side view of the same, in outline.

LYSIS SUCIENSIS (page 367).

Figure 3. Apertural view of an adult specimen of this species, from the Sucia Islands, collected by Dr. Newcombe.

LYSIS SUCIENSIS, var. CARINIFERUS (page 367).

Figure 4. Dorsal view of a specimen of this variety, from Brennan Creek, V. I., with two short spinous processes on the outer lip, presented by Rev. G. W. Taylor.

SOLARIELLA (RADIATULA ? var.) OCCIDENTALIS (page 368).

Figure 5 Dorsal view of a specimen from Brennan Creek, V.I., presented by Rev. G. W. Taylor, twice the natural size.

" 5 *a*. Basal view of the same.

PHANETA (?) DECORATA (page 369).

Figure 6. Basal view of a specimen of this species, from the Nanaimo mines, V.I., twice the natural size.

" 6 *a*. Dorsal view of the same, in outline, shewing the obtuse apex and peripheral keel.

Figure 7. Another specimen from the same locality, and as seen from above. Twice the natural size.

HELCION TENUICOSTATUS (page 371).

Figure 8. A specimen from Extension mine, as seen from above and twice the natural size.

" 8 *a*. Side view of the same, in outline, shewing the irregular, depressed conical form.

GASTEROPOD, GENUS AND SPECIES UNCERTAIN (page 371).

Figure 9. One of the specimens from the roof of the coal at the Nanaimo mines.

MARTESIA (?) PARVULA (page 372).

Figure 10. Right valve of a specimen of this species, from Extension mine, and twice the natural size.

ANATINA SUBCYLINDRACEA (page 374).

Figure 11. Side view of the most perfect specimen collected, from Brennan Creek, V.I., shewing the left valve.

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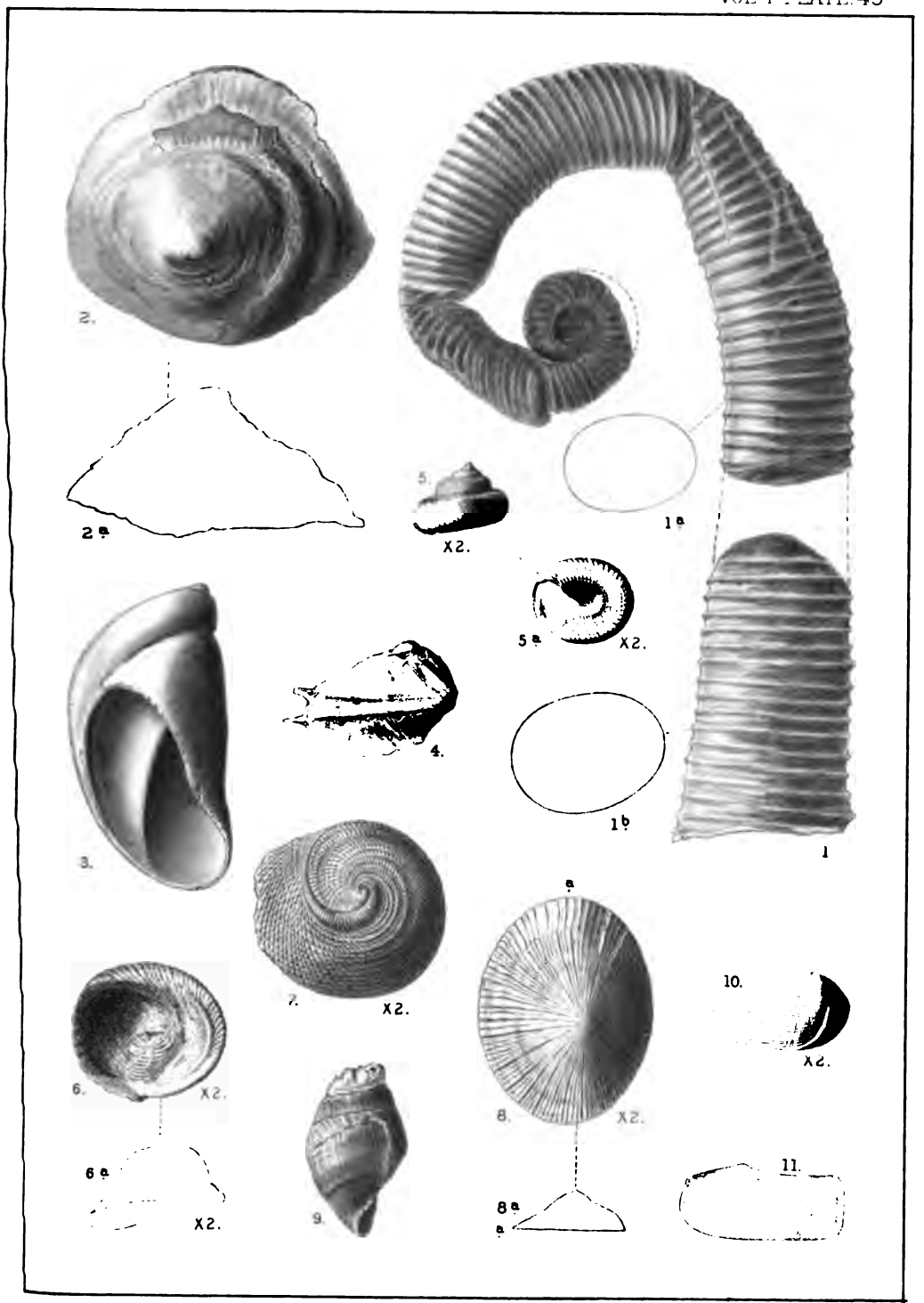

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PLATE XLVI.

PACHYDISCUS OTACODENSIS (page 340).

Figure 1. Side view of the specimen from Hornby Island, presented by Mr. Robbins.

CUSPIDARIA SUCIENSIS (page 376).

Figure 2. The right valve of this species from the Sucia Islands, as described in the text, but twice the natural size.

TELLINA NANAIMOENSIS (page 376).

Figure 3. Side view of the type of this species, from the Nanaimo River, V. I., and shewing the right valve.

NUCULA HORNBYENSIS (page 388).

Figure 4. Side view of an apparently adult shell of this species, from Hornby Island, and twice the natural size.

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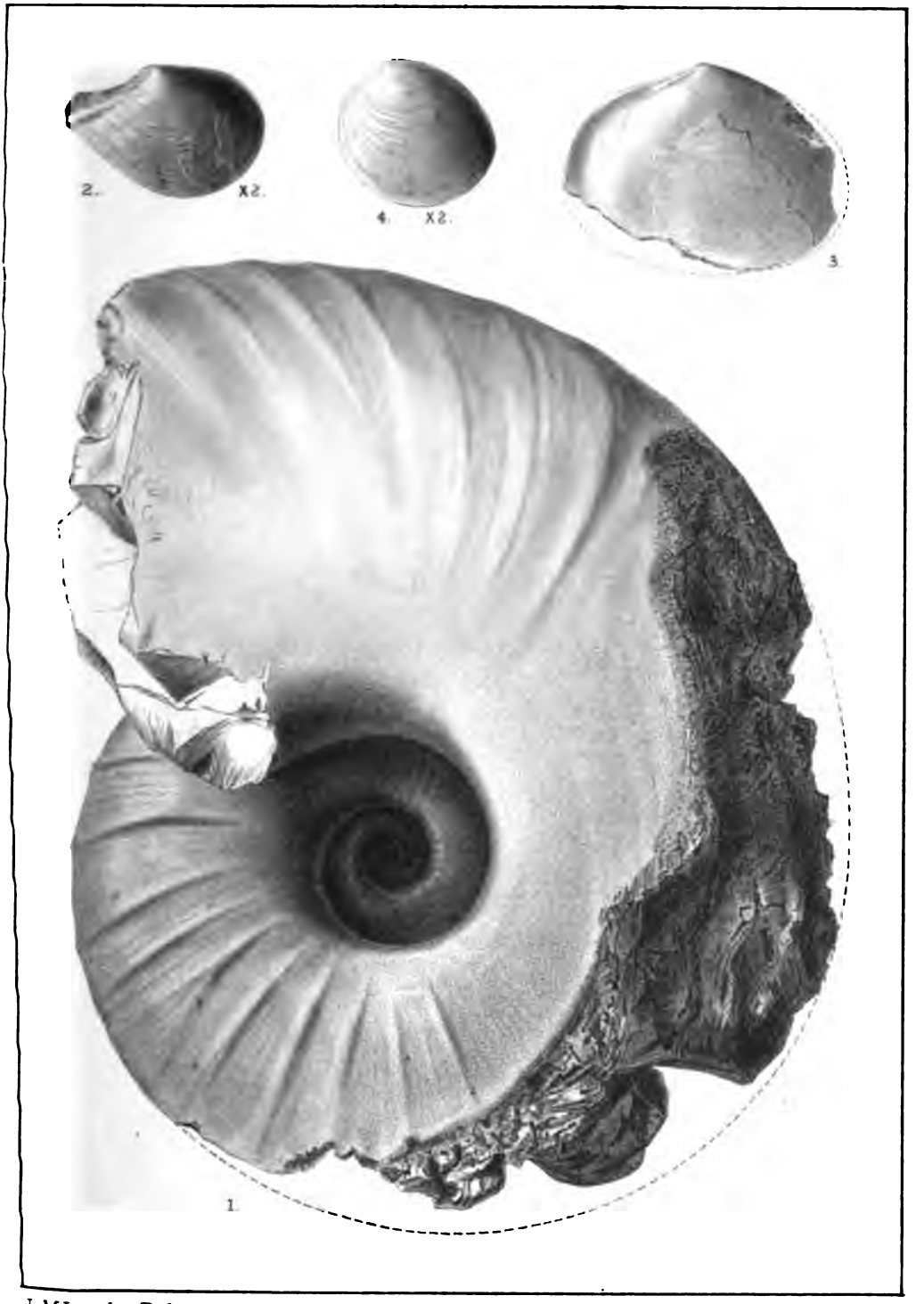

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PLATE XLVII.

PACHYDISCUS NEEVESII (page 342).

Figure 1. Side view of the type of this species, from James Island, nine twelfths the natural size.

YOLDIA DIMINUTIVA (page 390).

Figure 2. The left valve from Nanaimo upon which this species is based, four times the natural size.

PECTUNCULUS VEATCHII (page 391).

Figure 3. Side view of an adult specimen of this shell, from Blunden Point, V. I., collected by Mr. James Richardson in 1872.

Figure 4. Portion of the surface markings of a specimen from Texada Island, four times the natural size, and shewing the minute cancellation of the exterior.

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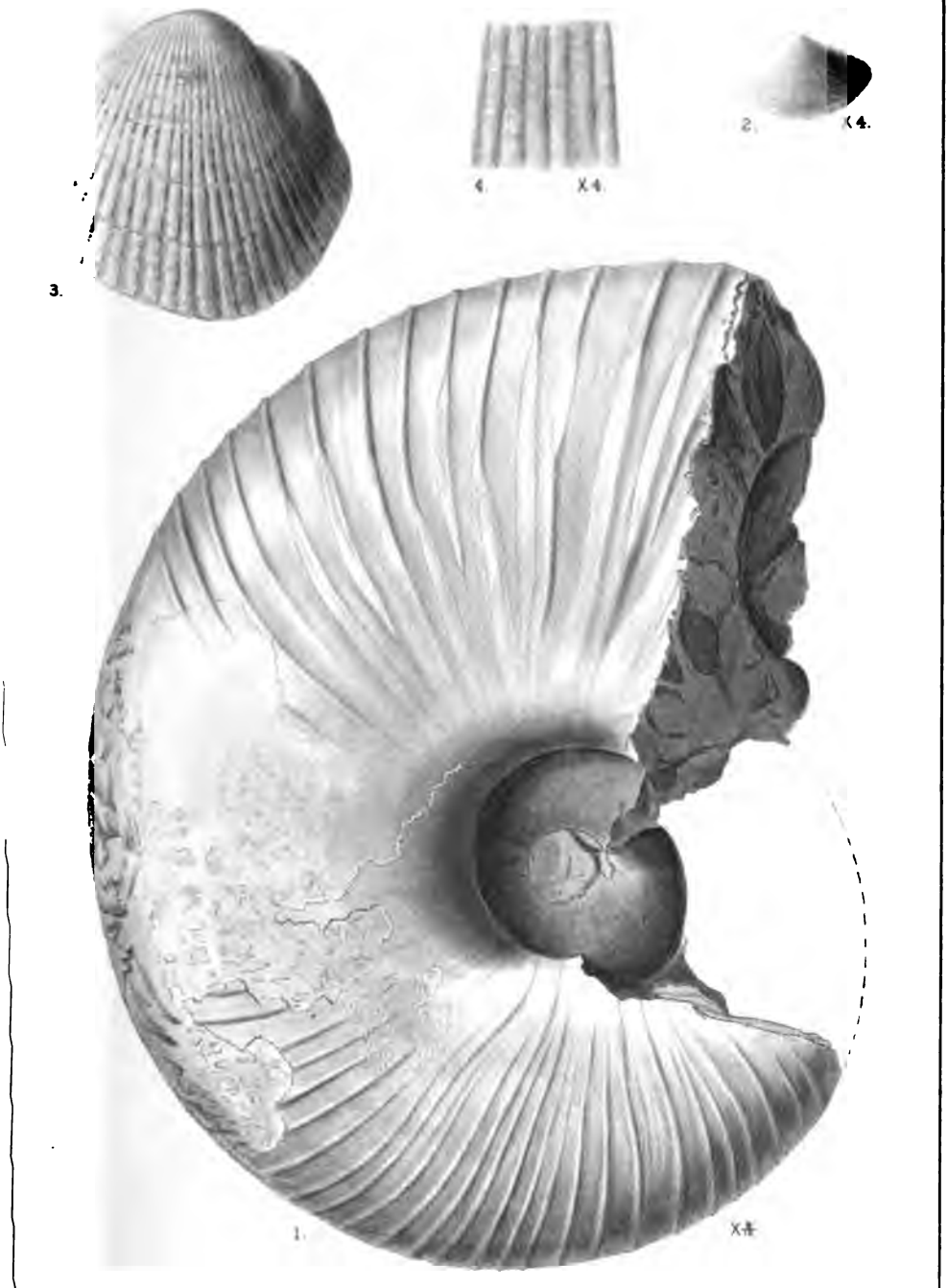

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PLATE XLVIII.

PACHYDISCUS (HARADAI ? VAR.) PERPLICATUS (page 346).

Figure 1. Side view of the only specimen that the writer has seen, from the Puntledge or Comox River, V. I., nine twelfths the natural size. The only place where any part of the siphonal region is preserved is at *a* (not A).

MODIOLA SISKIYOUENSIS (page 394).

Figure 2. Left valve of a small *Modiola* that is thought to be referable to this species, from Brennan Creek, V. I. Twice the natural size.

LITHODOMUS NITIDUS (page 395).

Figure 3. Side view of a specimen from the Nanaimo mines, shewing the right valve, and twice the natural size.

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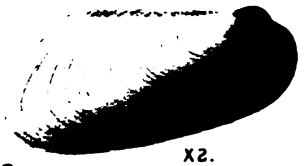
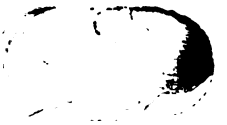


2. X2.



3. X2.

1. X⅓

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PLATE XLIX.

PACHYDISCUS BINODATUS (page 347).

Figure 1. Side view of the specimen from the Comox River collected by Mr. Harvey.

Figure 1 *a*. Peripheral view of a portion of the same, near the aperture, to shew the double row of nodes apparently characteristic of this species.

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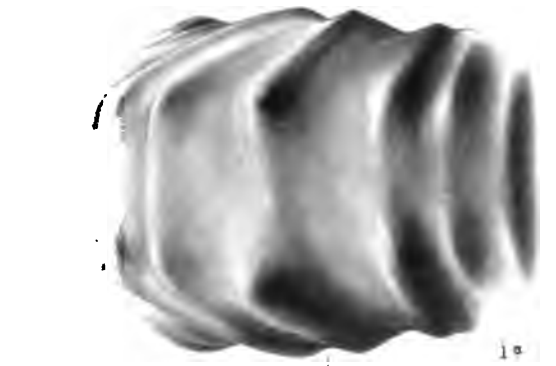

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PLATE L.

PACHYDISCUS MULTISULCATUS (page 349).

Figure 1.—Side view of the type of this species, from North West Bay, V. I., nine twelfths the natural size.

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PLATE LI.

HELCION GIGANTEUS? var. VANCOUVERENSIS (page 370).

Figure 1. Specimen from the Nanaimo River, V. I., as viewed from above.

LIMA SUCIENSIS (page 399).

Figure 2. Side view of a left valve of a specimen of this species, from the Sucia Islands. Twice the natural size.

RHYNCHONELLA SUCIENSIS (page 402).

Figure 3. The largest specimen that the writer has seen, from the Sucia Islands.

Figure 3 *a*. Front view of the same, to shew the amount of convexity of the closed valves, and the absence of a distinct mesial fold and sinus.

Figure 4. Portion of the ventral valve of another specimen, from the same locality, shewing the "narrow, prominent, acute raised ribs," supposed to be characteristic of this species.

TEREBRATELLA HARVEYI (page (403).

Figure 5. A ventral valve, from Extension mine, Nanaimo, V. I.

Figure 6. A dorsal valve, from Texada Island.

KINGENA OCCIDENTALIS (page 404).

Figure 7. Dorsal view of the specimen from the Trent River, V. I., described in the text.

Figure 7 *a*. Profile view of the same, to shew the proportionate convexity of the closed valves.

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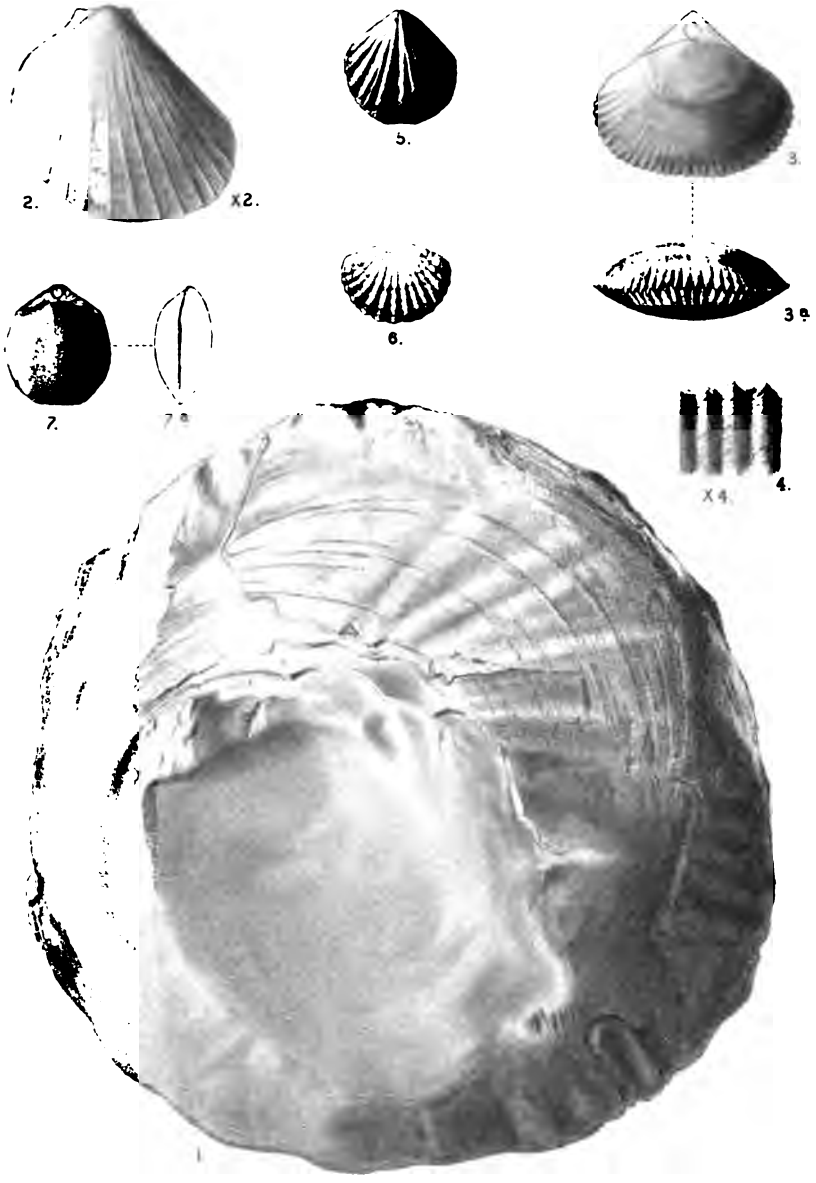

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